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CARCINOMA OF THE LARYNX—SOME CONCLUSIONS DERIVED FROM PERSONAL EXPERIENCE.*

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Malignant disease presents a most melancholy subject for our contemplation, accounting as it does for something like 10 per cent of deaths from all causes. Carcinoma of the larynx is, relatively speaking, a comparatively rare manifestation, forming but 1.8 per cent of the total deaths due to malignant disease. In spite of the relatively low incidence, the results from the treatment of carcinoma of the larynx are possibly more brilliant than those of malignancy located in any other deep lying organ. Unfortunately, the laity as a whole, and the profession to some degree, are in ignorance as to the remarkable possibilities for cure of malignant growths located in this organ. Greater strides have been made in the surgical treatment of carcinoma of the larynx than in possibly any other type of deep lying malignancy, if one is to judge by the results. It is interesting to note that only some 50 years ago that great authority on diseases of the larynx, Morell Mackenzie, could state: "The only possible termination is death." In what vivid contrast is the report of

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another famous laryngologist, Sir St. Clair Thomson, who achieved lasting cure in 76 per cent of 70 cases operated upon by laryngofissure with preservation of a useful voice. There can be no more tangible evidence of progress. Medicine in general, and laryngology in particular, are highly indebted to those pioneers whose untiring efforts made such achievement possible. They have succeeded in establishing laryngofissure and laryngectomy as safe and justifiable procedures, and demonstrated exact indications and limitations for these operations. Gluck and Sorensen in Germany, Sir St. Clair Thomson in England, Tapia in Spain, MacKenty, New, Lewis and Lynch in the United States, have all contributed to the success of laryngeal surgery in this dire affliction.

It is indeed unfortunate that the entire profession is not cognizant of the fruitful rewards of their efforts and does not avail itself of the benefits. Only too frequently is a fatal prognosis given; time and again a fatal outcome may be traced to dilatory tactics on the part of the attending physician.

This paper will present neither detailed statistics nor orthodox minutiae relative to symptoms, diagnosis and treatment. It is our aim to review our experience with carcinoma of the larynx, showing that under certain conditions it is not necessarily a fatal disease providing adequate and timely therapy be instituted. The basis of this paper is the experience gained from observation of over 500 cases of carcinoma of the larynx, of which 108 were operated, 86 having total laryngectomy and 22 a laryngofissure operation. These cases were in the main seen in private practice in the North Chicago Hospital and Michael Reese Hospital, although many were also seen in service at the Cook County Hospital, Research and Educational Hospital of the University of Illinois and at the Hines Veterans Hospital.

Etiology: A careful review of most of our material could establish no factual data with any significant bearing on the etiology. It is strange to note that only a few of our patients pursued any vocation that might lead to vocal abuse. A review of the vocational activities of our patients shows that singers, hucksters, lawyers, public speakers and the like were conspicuous by their absence. Smoking apparently did not play an important role as many nonsmokers, including sev-

eral women who did not indulge, were victims of this affliction. Addiction to drink was acknowledged by only a few. Heredity, so often stated as a predisposing cause, apparently played a minor role in our series of cases. The development of malignancy from precancerous lesions such as keratosis, papilloma or lues is likewise lacking in confirmation in our series. Few, if any, of our cases had such lesions prior to the development of their malignancy, so far as we could determine by history. Study of the age incidence shows that carcinoma of the larynx occurs most frequently between 50 and 60 years of age, although the decade of 30 to 40 years also has a fair incidence. Our youngest patient was 29 years of age and we have had several in the early thirties. The statement that carcinoma of the larynx occurs in older individuals requires qualification. Early middle life and even the late twenties are not immune. Cases have even been recorded in young people of 15, 16 and 18 years of age and several in the early twenties. These were mainly young women.

Classification: The site of origin, as a rule, was difficult to determine in the great majority of cases. The largest number seen by us were extrinsic, either previously so or by extension. In 137 cases the growth was sufficiently localized to permit determination of the site of origin. There were 124 intrinsic cases; of these the anterior two-thirds of the vocal cord was affected in 113 cases—true cordal carcinoma. The ventricular band was affected in nine cases, mainly in its central portion, and the ventricles of Morgagni in two. Thirteen cases of extrinsic carcinoma were sufficiently localized to enable us to determine the site of the origin, which was the epiglottis in four cases, the pyriform sinus in seven cases, the aryepiglottic fold in one case, and the post-cricoid region in one case.

Of equal importance to the site of origin is the anatomical extent of the growth. From a surgical point of view we designate as intrinsic only those growths that involve the true or false cord, or the ventricle of Morgagni in the anterior two-thirds of the larynx. Growths that arise from the epiglottic, aryepiglottic folds, arytenoids, postcricoid area, pyriform sinuses, or the posterior two-thirds of the true and false cords and primary intrinsic growths that involve these areas by

extension are designated as extrinsic. From the surgical point of view the terms extrinsic and intrinsic are synonymous, to us at least, with inoperable and operable. It is, of course, acknowledged that certain extrinsic growths may be amenable to surgical intervention by lateral or transhyoid pharyngotomy.

The inclusion of neoplasms of the posterior third of the true and false cords as extrinsic and unsuited for laryngectomy may excite comment. Eleven of our cases of carcinoma of the larynx in which the posterior third of the larynx was involved had a recurrence after a total laryngectomy, forcing us to include these in the extrinsic growths that are unsuited for laryngectomy. The mixed types represent those malignancies that are anatomically both extrinsic and intrinsic. Most of our cases are of these mixed types. Only 147 were intrinsic and therefore suitable for operation from an anatomical point of view. This is a most lamentable situation. It is realized that in all probability many of these cases were originally extrinsic and therefore inoperable from the start, yet our experience has been that most of these patients had been neglected for a long period of time. Most of them gave a history of hoarseness persisting from several months to well over a year. It is not difficult to conceive that were they all observed at the initial onset of the hoarseness they might have been seen in the intrinsic and, therefore, operable stage.

It is indeed a serious indictment of our profession to note that practically 75 per cent of the cases had been neglected to such an extent as to be inoperable. A careful consideration of our case history has shown that the fault lies both in the laity and the profession. The former have been negligent in procrastinating with hoarseness for a long period of time before seeking the aid of a physician. But the profession has also been at fault. Many of our patients were under the care of a physician, most frequently the family practitioner, who treated them for chronic laryngitis, without ever once using a laryngeal mirror. To our minds this is reprehensible. It should be our duty to instruct the physician, as well as the lay world in general.

We shall have attained success when the informed patient will seek immediate advice if afflicted with hoarseness that

persists more than a week or two. Furthermore, the informed physician will perform a mirror examination of the larynx in any patient complaining of hoarseness and have a biopsy performed if any suspicious lesion is present; obviously, if nothing frankly suspicious is seen, he will still keep the patient under careful surveillance so long as the hoarseness persists. In no other internal portion of the body is such an early warning apparent to the patient. The laity must be instructed to be "hoarseness conscious" as a sign of cancer of the throat, just as they have become "lump conscious" in cancer of the breast.

Pathology: A review of the gross pathological features of our material has taught us that carcinoma may simulate many benign and inflammatory lesions. We are forced to admit that we have erred several times in arriving at a diagnosis of tuberculosis or lues, only to find ultimately that we have been dealing with a malignancy. We have seen apparently benign papilloma or fibroma reveal a malignant structure under the microscope. We have also experienced the coexistence of carcinoma with tuberculosis or lues and, in fact, have seen one specimen showing all three processes. We have, therefore, promulgated the following dictum:

"A biopsy is indicated in every case of laryngeal pathology in which carcinoma is diagnosed, suspected or even remotely considered." We are well aware of the theoretical possibility of hastening the spread of a malignant lesion, by the trauma incident to biopsy, and we make it a condition of the procedure that the patient permit immediate intervention if the report is returned as malignant.

Histology: The histological characteristics of carcinoma of the larynx have been repeatedly described. We have reviewed a series of microscopic sections on 72 cases seen within the past five years, and have found them to be squamous cell types in 69 instances and transitional cell epitheliomas in three instances. Lymphoepithelioma has not occurred in this small series; although adenocarcinoma and sarcoma have been described, we have none in our series.

The histological characteristics are extremely important to the clinician. We, as well as others, have written on the slow growth, dilatory extension and metastasis and relative

resistance to irradiation that characterizes the adult differentiated squamous cell neoplasm in contrast to the rapid growth, early wide diffuse metastasis and relative radiosensitivity of the nondifferentiated embryonic carcinomas, especially the transitional and lymphoepithelial varieties. As stated before, practically all of the epithelial malignancies of the larynx are of the adult fully differentiated types. This accounts for the well known clinical fact that most laryngeal malignancies grow slowly and metastasize late. The explanation, in the past, accounting for the restriction in spread of a laryngeal neoplasm was that it was enclosed in a cartilaginous box devoid of lymphatics. That this assumption does not have a factual basis is obvious. The cartilaginous box, as is well known, is deficient in cartilage, superiorly, inferiorly and posteriorly. Moreover, recent investigation has shown that the cartilage has a rather plentiful supply of lymphatics. The true explanation undoubtedly lies in the biological characteristics of these adult fully differentiated neoplasms.

Cervical Adenopathy: The presence of lymphadenopathy in association with a malignancy of the larynx offers a poor prognosis. Yet many believe that such a condition is not altogether hopeless. Crile in the United States and Trotter in England have popularized the surgical removal of malignantly infiltrated cervical lymphnodes and reported some degree of success. Our experience has been a most melancholy one. No patient afflicted with a carcinoma of the larynx and exhibiting palpable lymphnodes is alive today. Seven patients with a primary lesion of a larynx that was intrinsic, surgically speaking, and presenting palpable lymphnodes were operated upon by complete laryngectomy and bilateral block dissection of the lymphnode bearing areas of the neck. Not one survived any appreciable length of time. Apparently the theoretical assumption that palpable lymphnodes are frequently enlarged by an infectious process, rather than malignant metastasis, is not borne out in our small experience. We are forced to conclude that palpable cervical lymphadenopathy makes for a hopeless prognosis, no matter how favorable the laryngeal lesion may appear, and is, therefore, a contraindication to surgery.

Motility of the Vocal Cord: Impaired motility of the vocal cord has been repeatedly and unfortunately stressed as an

early sign of malignancy. It has further been affirmed by many writers that the motility of a cord was a differential characteristic that aided in the distinction between a malignant and benign process on the false assumption that a malignant growth was associated with a more or less fixed cord and that a freely motile cord tended to exclude malignancy. Of the 22 cases of intrinsic carcinoma operated upon by laryngofissure not one case of fixed cord was observed in spite of the fact that hoarseness and a visible tumor were present. Our conclusions are obvious — impaired motility is not an early sign of malignant disease of the vocal cord and its absence does not indicate the presence of a benign process. A fixed or poorly motile cord was present in 39 instances of the 86 cases of intrinsic carcinoma operated upon by laryngectomy. This higher incidence (45 per cent) in the more advanced stages shows that this sign is indicative of a well developed lesion rather than an early one.

Furthermore, a fixed or poorly motile cord was found in every case in which a recurrence was noted after laryngectomy. And lastly, all cases of the mixed type of intrinsic and extrinsic malignancies, that we have termed extrinsic and inoperable, were associated with a fixed cord. We, therefore, are forced to assume that malignancy may be present in a freely motile cord; that fixity speaks for progression of the lesion; that a fixed cord contraindicates laryngofissure and influences the prognosis for the worse if laryngectomy is employed.

Treatment: The modern treatment of carcinoma of the larynx resolves itself into a consideration of surgery, irradiation or both.

Irradiation Therapy: Our experience, limited it is true, has consisted in the use of deep X-rays and interstitial application of radium into the growth after a window resection of the thyroid cartilage or some other surgery of approach had been performed. Our experience with irradiation therapy in the past has been a most unhappy one. Aside from the frequent complication of dermal and cartilaginous dystrophies we have observed little if any permanent effect upon the growth itself. Within the past few years, however, important technical advances in the use of these potent agencies

has enabled us to observe more encouraging although not overly impressive results.

We are interested in two methods at the present time. One is the use of the 4 gm. radium pack. This consists in the use of 4 gm. of highly screened radium at a distance of 6 to 15 cm., utilizing several portals of entry. Tremendous doses may be administered to a lesion within the larynx without the disastrous sequelae noted in our earlier experience. We have noted the disappearance of the lesions treated in a number of cases but unfortunately several recurrences have occurred and the method has not been used over a sufficiently long period of time to determine the final outcome.

The second method is Coutard's protracted fractional dosage with X-rays. The results of this method have been similar to those of the pack since primary disappearance of the growth seems to occur, only to be followed by a goodly number of recurrences. Certainly the results from both of these methods do not compare with what we can expect from laryngofissure and laryngectomy in properly selected cases. Yet these methods have superseded the use of interstitial irradiation with radium or radium emanation in our practice. We still employ irradiation as a postoperative adjunct to surgery.

Operation by Laryngofissure: This procedure appeals to us as the operation of choice. It is, when compared to laryngectomy, nonmutilating, relatively free from marked postoperative shock, and usually associated with the retention of a serviceable voice. Unfortunately it is indicated in only a small percentage of the cases observed—in our experience a very small percentage indeed. In our opinion it is indicated only when the neoplasm is small and restricted to one vocal cord. The disease must not have invaded either the anterior or posterior boundary of the cord and the cord must be mobile. The lesion must, furthermore, be an adult squamous cell growth with no palpable glands present in the neck. When these indications are met the operation should prove adequate for a lasting cure in better than 80 per cent of the cases. Of 22 cases treated by this method all but one are alive and doing well for a period of time varying from two to 13 years. Nineteen of the original cases show no recurrence. In one instance a recurrence appeared four years after laryngofissure. The patient refused laryngectomy and ex-

pired seven months later. In the other two recurrence was noted, one three months and one seven months after operation; laryngectomy was performed and both patients are alive and well, seven and three years later. All 19 cases in which laryngofissure was sufficient retained a serviceable voice. The tonal quality and strength varied in different individuals but was quite satisfactory. It is indeed unfortunate that we are not able to see more of our malignant laryngeal cases in such early stages that this procedure will effect a cure.

The technique has been so well described by Sir St. Clair Thomson that it leaves little for us to add. We have modified it in minor detail, using an electrically driven circular saw devised by one of us for performing the division of the thyroid cartilage, and endothermy in excision of the growth.

Laryngectomy: This procedure is still the therapeutic sheet anchor in the management of these unfortunate individuals. The indications for its use are precise. Any intrinsic laryngeal malignancy that is not suitable for laryngofissure may be treated by laryngectomy with some hope for success. Of our 86 cases operated upon by laryngectomy only 51, or 59 per cent, are alive five years after operation. As only intrinsic lesions were operated upon the only explanation of the high percentage of recurrences is the presence of microscopic metastasis in the cervical lymphatics. The higher proportion of cures by laryngofissure can be explained by the fact that this procedure is utilized in early small localized growths at a stage where microscopic extensions into the neck have as yet not occurred. We have had but one operative death from shock and cardiac failure. This is surprising as the operation is extensive and usually performed in elderly individuals, who, as a rule, are rather poor surgical risks. This rather low operative mortality is an index of the progress made in the development of laryngectomy as a surgical procedure. We are indebted to MacKenty more than any other worker in this field for these technical innovations that aid in the prevention of postoperative pulmonary complications, with the subsequent lowered mortality. To him and his associates we are indebted for a precise preoperative and postoperative routine that also has an effect in the production of such marvelous results.

The technique of the surgical extirpation of the larynx has been so well described by MacKenty, Brandon and others

that it would be superfluous to repeat it here, except that we urge the use of endothermy in the procedure.

Voice After Laryngectomy: The social rehabilitation of the laryngectomized patient is a matter of great importance. It may be the deciding factor in obtaining consent for the operation. The fear of being transformed into a mute person has been an important reason in the patient's outright refusal of the procedure or in his hesitating while valuable time is lost.

We may assure these patients that a more or less competent voice, either by the use of an artificial larynx or the establishment of a buccoesophageal voice will eventually result. It is obvious that this is very important for both economic as well as social reasons. Time will not permit us to consider our experience with the MacKenty artificial larynx and its modifications, or the excellent results that are frequently observed in the production of a vicarious buccoesophageal voice. We would like to mention in passing a peculiar form of psychoneurosis that developed in four of our patients. These individuals were unable to use the MacKenty larynx, even after protracted periods of teaching by competent instructors. They were, furthermore, unable to learn to produce buccoesophageal speech. As there were no organic difficulties that we could determine and as these individuals so affected were highly neurotic and defeatists in temperament we could only ascribe this lack of success on the basis of a psychoneurosis not unlike the "mental hazards" so frequently observed in the realm of sport.

We would also like to go on record at this time and mention a new method of speech production in these patients developed by one of us (M. R. G.). This resulted from an unusual incident that occurred in one of our patients, who had a laryngectomy performed in 1923 and did not take very kindly to the use of an artificial larynx. After thinking his condition over very carefully, one day he heated a curved ice pick red hot and without any anesthesia passed the pick through the skin just above the tracheal opening in the neck and continued on until the heated instrument entered the hypopharynx just below the base of the tongue. He repeated this three times within a period of two months until a fistula

formed, that has persisted ever since 1927. By placing his thumb over the tracheal opening, air is forced through the fistula into the hypopharynx with the production of a low pitched tone, which is then modulated by the tongue and lips into speech. The quality of this voice is remarkable and far superior to that obtained by buccoesophageal speech, or artificial larynx. Following this example we have duplicated the procedure, utilizing the diathermic current and an electrode not unlike that described by one of us for use in intumescent inferior turbinates.

It is too early as yet to give actual results. We have had several satisfactory results and some failures. In one case we used too much current and so caused too large a tract to form, with the consequence that difficulty developed in swallowing liquids. We have also had several cases in which not enough destruction was effected so that the fistula would either not form or would last but a short time and then close. At the present time we are utilizing a fine indwelling ureteral catheter which we permit to remain *in situ* until an epithelialized tract has formed. When more of these cases have been treated in this manner, we will render a complete report.

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CARCINOMA OF THE LARYNX: SURGICAL CONSIDERATIONS.*

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St. Clair Thomson,¹ introducing the subject of laryngofissure in his book on "Cancer of the Larynx," makes the following statement: "This operation aims at removing a malignant growth surrounded by a margin of healthy tissue while retaining a serviceable voice with no more than the usual operative risks and with lasting freedom from the disease. We are of the opinion that all this is attainable and depends in the first instance on the proper selection of cases." That, ladies and gentlemen, puts the matter in a nutshell, theoretically speaking. To accomplish this objective, however, requires a far more critical analysis than I shall be able to offer in the brief time allotted me. I shall therefore attempt to cover only the salient facts as we know them today.

To begin with, it is pretty generally agreed that the operation itself in skilled hands is comparatively easy, involves but little risk and when successful leaves the patient with his normal airway and a more or less serviceable voice. Such variations of technique as have been suggested from time to time have had much to do with lessening the operative risks, such as aspiration pneumonia and infection, and possibly in some cases preventing recurrences. I refer particularly to the subperichondral dissection of the lesion before opening into the laryngeal cavity, the removal of adjacent cartilage where infiltration is suspected, electrocoagulation and radium therapy.

Granting all of this, the fact still remains that success or failure in the operation rests on one all-important question, namely: When is it indicated? The surgeon who can answer this question correctly is the one who will obtain the highest percentage of cures, other considerations being equal.

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Briefly, there are two aspects to the subject of indications: first, the location and extent of the lesion, and second, its degree of malignancy or radiosensitivity. Most observers agree that an isolated lesion on one vocal cord whose both ends are free of disease, where there is no subglottic extension and no impairment of mobility, offers a better chance for cure by this operation than by any other procedure. But, when the lesion extends to the anterior commissure or the subglottic space, or where there is impairment of mobility we find a divergence of opinion.

Thomson, Jackson,² Tucker³ and New⁴ still believe these cases are amenable to laryngofissure with certain qualifications having to do with the grade of malignancy. It is in this type of case that the more radical additions to the operation as originally planned have been added. I refer particularly to subperichondral dissection, excision of thyroid cartilage and the postoperative use of electrocoagulation and radium. Mackenty,⁵ Beck⁶ and Marschik,⁷ on the other hand, have stated that when the commissure is involved or there is impaired mobility of the cord, the operation is no longer indicated. As a matter of fact, such statistics as are available bring home the fact that the percentage of recurrences increases in direct proportion to these findings. For instance, St. Clair Thomson states that in 37 cases of isolated cord lesions, he obtained 84 per cent of cures for a three year period. In nine cases of cord fixation only 44 per cent were cured for the same period. He makes the further observation that subglottic extension is an unfavorable finding, thus admitting that the operation may not have been properly indicated in some of the cases reported. Mackenty⁸ states that 35 per cent of laryngofissures return with recurrence. Coming from a man who probably performed more laryngectomies than any other laryngologist in the world, this statement should carry great weight, inasmuch as he had the opportunity of observing a large number of patients previously operated by laryngofissure.

New and Fletcher,⁴ in a series of 41 laryngofissures, found 13 (32 per cent) of recurrences in from three to six years and add the significant observation that subsequent laryngectomy is not so successful. It is natural, therefore, to inquire into the reasons for recurrences, assuming that in

every instance the surgeon removed all of the disease, including a zone of healthy tissue. The answer lies in the all important question of the degree of malignancy. New and Fletcher contributed a most valuable series of observations bearing on this topic by making histologic studies of apparently healthy tissue adjacent to the lesion. They showed that the extent of microscopic invasion was in direct proportion to the grade of malignancy. In Grade I, there was no extension; in Grade II, the growth extended 5 mm. beyond the apparent limits of the lesion; in Grade III, the average area of extension was 5.9 mm., and in Grade IV, it was 5.6 mm. In some of the latter cases the extension was as far as 15 mm. They conclude, therefore, that Thomson's dictum that 7.5 mm. is a safe margin for excision cannot always be depended upon. It becomes evident, therefore, that the surgeon who depends on the gross appearance of the lesion for his indications is likely to be frequently disappointed and chagrined. No one who is up to date can afford to disregard the evidence of the microscope and in planning the procedure to be adopted in a given case, must weigh carefully the report of the pathologist. I, personally, would never go through with a laryngofissure without a previous biopsy and careful study of the frozen section. And this refers not only to the borderline cases, but to the isolated cord lesions as well.

In the presence of a highly malignant lesion I should prefer to recommend the more radical operation of laryngectomy even though the lesion apparently was favorable for excision by way of a laryngofissure. As a matter of fact, in my experience, only a small proportion of the cases I have encountered were sufficiently localized to admit even considering laryngofissure. In 25 successive cases seen in private practice, only one was properly within this category. I find that I am not alone in this observation. Mackenty⁵ states that in a period of one year he found only one case favorable for thyrotomy out of a total of 60.

It is unfortunate that the public at large is so careless as to disregard the one symptom which should lead them to the laryngologist at a time when the lesion is most amenable to laryngofissure; namely, hoarseness. Certainly, to be hoarse is not natural and yet, how it is possible for so many individuals to go about their daily life in the belief that they are

suffering from a prolonged cold without even seeking a mirror examination is beyond me. Yet, such is our observation. The history in practically every case we see shows that hoarseness has existed for months. However, the fault is not always with the patient. Many early cases are missed through the neglect of the examining practitioner to inspect the larynx. It is even possible that some laryngologists have been careless in failing to follow up suspicious cases. It is a safe dictum that every case of protracted or increasing hoarseness in which there is a unilateral distribution of the findings should be subjected to a biopsy along with a Wassermann test and chest examination. When the public, as well as the profession, becomes aware of the significance of hoarseness and its possible implications, we laryngologists will be in a better position to offer the laryngofissure operation as a cure of cancer of the larynx.

However, this Utopian era still being more or less theoretical, we shall have to continue exercising the greatest care in the selection of cases for the operation. The determination of the extent of the lesion and its true type will always require the utmost skill of the laryngologist, repeated examinations in doubtful cases, prompt biopsy and thorough study of the specimens.

Finally, if confronted with a border-line case where the indication for laryngofissure is not sufficiently clear, we should not shrink from recommending laryngectomy because the operation, as you will soon learn, is not the dangerous and mutilating procedure many have pictured it. On the contrary, it must be viewed as a life saving measure attended with only a nominal primary mortality and offering a good prospect of permanent cure.

And now we come to the second part of my paper, a subject of tremendous interest whose history alone could take up an entire evening.

A little less than 50 years ago a bitter controversy raged throughout Europe because of a difference of opinion between the English and German physicians attending Prince Frederick III, later Emperor of Germany. The acrimonious debate over the diagnosis and treatment of cancer of the larynx from which the royal patient perished furnished material for

two most interesting booklets,⁸ later published by the two factions setting forth their sides of the argument which, even today, is a most fascinating bit of reading. Had the operation of laryngectomy been as well advanced as it is today there is little doubt that the Emperor would have survived. From the time that Billroth performed his first hemilaryngectomy in 1873, through the advances in technique by Gluck, Sorenson, Solis-Cohen, Cisneros, Butlin, up to the more recent refinements by Moure and Mackenty, there has been a steady progress which marks one of the most brilliant chapters in laryngology.

From 1873 to 1876, 12 laryngectomies were reported with only one ultimate cure; from 1876 to 1886, 108 laryngectomies with 21 ultimate cures, or 19 per cent; from 1886 to 1896, 156 laryngectomies with 49 cures, or 24 per cent; from 1896 to 1909, 30 laryngectomies with 20 cures, or 66 per cent.⁹ From 1922 to 1926, Mackenty¹⁰ reports 58 laryngectomies with only five recurrences, or 89 per cent of cures, and his last report of over a hundred cases bears out his previous favorable experience. In the early days of this operation, over 50 per cent of the patients died of postoperative complications, such as hemorrhage, mediastinitis, erysipelas, pneumonia, sepsis, etc. Steady refinement of technique rapidly reduced the primary mortality until in 1922, Tapia¹¹ reported 107 cases with only five operative fatalities. Mackenty reported 230 laryngectomies up to 1929 with an operative mortality of less than 3 per cent. The important factors which contributed to this marked reduction in primary mortality were, first, the suturing of the tracheal mucosa to the skin of the neck, originally devised by Gluck and later improved upon by many others; second, improved hemostasis and better technique in the closure of the hypopharyngeal defect; third, the corking of the trachea to prevent aspiration of blood and mucous as devised by Mackenty, and fourth, new methods of anesthesia. Numerous other details of technique were worked out from time to time, each of which tended to eliminate some existing difficulty, all of which aided in shortening the operating time and speeding up the convalescence.

At the present time we find that there are two main methods of attack, the one stage and the two stage operation. The latter, which has gone through numerous variations in

the past 50 years, has as its main objective the anchoring of the trachea to the skin and the walling off of the deep facial planes a week or two prior to the act of removing the larynx. The one stage operation, popularized by Mackenty,¹⁰ I believe is more widely practiced than the two stage, although the latter has its advantages, particularly in cases of severe dyspnea where tracheotomy is urgent.

Indications: Generally speaking, any intrinsic carcinoma of the larynx in a patient who is not too debilitated, whose cardiovascular system is in good condition for his age, and who is not a subject of diabetes, is an indication for total laryngectomy. Locally, the important things to know are that the disease does not involve the pyriform fossa or base of the tongue, that there are no metastases in the neck and that the tracheoesophageal party wall is not infiltrated. And, even among these contraindications there are exceptions to the rule, depending on the degree of the malignancy and the general resistance of the patient.

Preparation: Mackenty has emphasized the tremendous importance of adequate preparation before the operation. In the first place, patients with pronounced metabolic imbalance that cannot be corrected are rejected entirely. Secondly, all cases with cardiovascular degeneration are properly digitalized; thirdly, careful diet and attention to the excretions are followed for at least a week; fourthly, all diseased teeth are extracted and the mouth cleansed of infection.

Anesthesia: There is a wide difference of opinion on this point, ranging all the way from those who favor intratracheal ether to those who rely entirely on local infiltration. Between these extremes we have combined local and general, colonic ether, Avertin and scopolamine-morphine with local infiltration. One thing is certain, namely, that it is advisable that the patient be at least somnolent during the greater part of the operation, because of the great mental and nervous shock, which is otherwise a tremendous factor in the convalescence. My own preference is for scopolamine-morphine combined with local infiltration. It has been my experience that the patients usually have no recollection of the operation, although at the time they were easily aroused and co-operative. There is also much to be said in favor of Avertin or colonic ether, both of which are fairly safe and leave the operative field free

from anesthesia apparatus. Naturally the speed with which the operation is performed has much to do with the amount of anesthesia consumed and consequently bears a direct ratio to the speed of recovery. I have seen a laryngectomy that consumed five hours and I have seen others that required only two hours. As in any other surgical procedure, there are surgeons and there are surgeons!

Technique: Volumes have been written on this phase of the subject. Details and variations, too numerous to mention, have from time to time been described. In the main they all have the same objective, namely, to skeletonize the larynx, sever it from the trachea, remove the larynx, sew the tracheal stump to the skin, repair the hypopharyngeal defect and provide drainage. Of the various types of skin incisions, the T-shaped, with its cross bar at the level of the hyoid, is probably the most popular. Recently Brandon¹² described laryngectomy through a single midline incision which seemed to simplify matters greatly and do away with unnecessary cutting of muscles and fascia with consequent bleeding. I used this method in one case and found it comparatively simple and very practical. Certainly there seemed to be plenty of room to work and there was less necessity for drainage than with the classic T-shaped incision. I intend to employ this method in the future should the opportunity present itself. Following the incision through the fascia, the usual technique is the separation of the pretracheal muscles and their division at the point of attachment to the cricoid and thyroid cartilages. The thyroid isthmus is separated from the cricoid by peeling it downward and if it be large enough to get in the way it should be clamped and divided in the midline. The larynx is then skeletonized by dissection from the fascia and muscles, the inferior constrictor and stylopharyngeus being severed close to the larynx, taking care not to open the pharynx near the superior cornu of the larynx. The superior laryngeal vessels are exposed by pulling up on the hyoid bone and are tied off. At this point the technique varies. There are some who detach the larynx above first and dissect it off the esophagus from above downwards, and there are others who detach it from the trachea first and dissect it off from below upwards. My own preference is for the latter procedure. As soon as the larynx is severed from the trachea the laryngeal cavity is packed with iodoform gauze and the

tracheal opening is immediately plugged with a heavy conical rubber tube which should cork it tightly enough to prevent secretions running into the trachea and should be long enough to be held out of the way of the surgeon and his assistants. This tube must be kept in place until the tracheal stump is to be sutured to the skin.

After the larynx has been removed, all bleeding points must be securely tied and then attention given to the closure of the hypopharyngeal opening. This is accomplished by two rows of catgut so placed as to invaginate the mucous membrane toward the pharynx and esophagus. The stump of the trachea is next prepared by the excision of all or part of the upper ring, freeing of the tracheal mucosa for a sufficient distance to permit suturing to the skin of the neck which must be freely undermined to permit its approximation to the mucosa without tension. It is well to anchor the trachea to the neck by means of two or three tension sutures passed through a lower ring and brought through the skin at some distance from the wound, where they are fastened over buttons or lead plates. This relieves the mucocutaneous junction of any strain from the tracheal tug. A large size feeding tube is passed through one nostril into the esophagus for a distance of about six inches and secured to the nose and forehead by adhesive. The skin, muscles and fascia are now brought together, care being especially necessary in the T-shaped incision that the union at the junction of the bars in the midline be secure. Drainage is provided at the ends of the T by means of rubber tubes wrapped in vaseline gauze. In the new technique, where a single midline incision is employed, the wound is closed completely and drainage effected through two independent stab wounds on either side, just above the level of the tracheal opening.

The essential features of the technic which will safeguard the patient against complications are:

1. Careful hemostasis and the exclusion of blood and secretions from the trachea.
2. Secure anchorage of the trachea to the skin and a well fitting tracheal tube for the convalescent period; a No. 6 tube wrapped in conical fashion with vaseline gauze is the safest means of excluding postoperative secretions.

3. The use of suction during the operation for the removal of blood and mucous.

4. Proper placement of the drainage tubes.

The postoperative treatment requires constant vigilance and utmost care. The nurse must be properly instructed in the replacement of soiled dressings, in the use of the suction apparatus to clear the trachea and in the removal, cleansing and replacement of the inner tube. The patient must be advised not to swallow any more than is absolutely necessary and if the secretion of mucous is excessive, atropine may be given for a short time, providing there are no contraindications. A high caloric liquid diet is given through the feeding tube at frequent intervals and the patient encouraged to sit up and move about as soon as possible. The drainage tubes are not removed in less than a week, but are kept patent by the passage of a small catheter attached to a suction apparatus. The nurse may be instructed in this technique as well, since frequent aspirations are necessary. Mackenty recommends saline irrigations through the drainage tubes. These I find superfluous and rather messy. As a rule, the drainage tubes are removed at the end of a week and replaced with smaller tubes or gutta percha, depending on the amount of secondary infection and consequent secretion. In successful cases the wounds may be completely closed in from two to three weeks, at which time the feeding tube is removed and the patient permitted to swallow.

We now come to a consideration of an aspect of the question which inspires the greatest dread in the patient, namely, the loss of the speaking voice. I have seen patients absolutely reject the operation and face the inevitable rather than the prospect of living the remainder of their lives without a normal speech apparatus. I am here to say that serious though this problem may be, it is nevertheless exaggerated beyond its true importance. It seems ridiculous for an individual having the choice of a probable permanent cure without any other disability and inevitable death to shrink from a disability which can in a large measure be ameliorated. Patients have been repeatedly demonstrated at various laryngological societies who have acquired a new method of speech which enabled them to be heard at reasonable distances and to those who will not or can not learn there is the artificial larynx,

a poor substitute it is true, but nevertheless a means of speech which, from the technical standpoint, is still in its infancy. Patients can be taught pharyngoesophageal speech and can develop it to an amazing degree. The ability to swallow air and expel it against vibrating pharyngeal folds while enunciating has come naturally even to individuals of lower intellectual status. Some are content with merely a buccal voice, which is not really a voice, but merely a whisper that can be developed sufficiently to permit conversation at close quarters. At any rate, the picture is far from being as black as it is painted. The satisfaction of being spared life to be enjoyed normally in every other way should far outweigh the disadvantages of impaired speech.

Carcinoma of the larynx is a curable disease. When men of large experience report permanent cures in 75 to 85 per cent of all intrinsic cases, I believe that the profession and the public at large may look to the laryngologist with greater hope than is the case with carcinoma in other regions. And now that progress is being made in our knowledge and application of radium therapy, the horizon seems even brighter than ever. Certainly no man should die of carcinoma of the larynx if he but take advantage of the vast accumulated knowledge and skill which have been developed in the past 50 years, provided he heeds the warning symptoms and seeks relief at a fairly early date.

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NOTES ON THE SUBMUCOUS RESECTION OF THE NASAL SEPTUM.

DR. HARRY L. BERMAN, New Haven, Conn.

The operation commonly employed for the correction of deviations and thickenings of the nasal septum is technically a difficult operation. There are so many variations and angulations to which the septum is subject that very often the procedure for its correction must be thought out and planned.

To me there is no operation in otolaryngology so satisfying as performing a thorough submucous resection of the nasal septum without tearing. I shall not go into a complete technical description of the operation, but will point out what I have found to be useful in certain conditions and phases of the operation.

In regard to cleansing or attempting to sterilize the nose before operating, patients do well if no attempt is made at irrigating or painting the nose. The patient has an immunity against the organisms ordinarily present, and I believe the secretions present serve some protective purpose. I do not use any preliminary medication before operating, and allow the patient a cup of coffee for breakfast if the operation is to be done in the morning.

For anesthesia, I have found the rubbing in by cotton applicators dipped in a mixture of equal parts of 20 per cent cocaine and adrenalin 1-1000 over the whole region to be operated entirely satisfactory. It not only produces perfect anesthesia, but also renders the operation practically bloodless. If the cotton applicators are squeezed so that no solution drips off, there should be no trouble with the toxic effects of the cocaine. A sufficient number of applications should be made so that the patient reports only a feeling of pressure—not pain. By applying the cocaine in this manner, every part to be operated on can be anesthetized. At the line of the intended incision, a few drops of 1 per cent procaine solution should be injected to limit bleeding at this point.

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The position of the patient is important. It is not wise to operate with the patient in the sitting position. Fainting and collapse will be frequent. I always have the patient recumbent on the operating table and stand while operating. Thus one is not inconvenienced or held up by the fainting of the patient.

One should always have in mind the possibility of the patient being sensitive to cocaine. It has been my practice to apply a little of a mixture of cocaine and adrenalin, of the same strength that is to be used at the operation, to the septum at the patient's visit to the office when the subject of operation is being discussed. If the patient shows no reaction to this, then one may feel secure that the patient is not sensitive to the local anesthetic and will tolerate well the amount to be used at the operation. A normal individual certainly will tolerate it, and if one is sensitive to cocaine, he will show it when a small amount is used.

A sterile spring-type clothes pin placed on the head mirror will permit the operator to shift the position of the mirror without contaminating his hands.

I employ suction for the bleeding, which usually is very slight. An Eustachian catheter of large calibre when straightened makes a good suction tip. In regard to selecting the side to operate on, I choose the side with the most angulation or deviation because on this side the elevation is more difficult and can be more readily seen. In cutting through the cartilage at the line of incision, the knife should be held at an angle to the cartilage, with a tendency during the incision to lift the cartilage away from the opposite adherent mucous membrane. This will prevent perforation on the opposite side. Be sure the incision is as far anterior as is necessary to remove an anterior obstruction and that the incision is carried down onto the floor. Frequently one will find a sharp angulation of the cartilage at its upper border running parallel to its crest. It is important to bite away most of this. A narrow biting forceps will accomplish this. If this is not removed, the mucous membrane, instead of dropping down from the mid line, will drop down away from the mid line. There is frequently a thickening of the nasal crest of superior maxilla or of the ridge of vomer anteriorly that does not come away in breaking off the vomer. A narrow angular

ronguer such as dentists use is very valuable in biting this away.

Obstructions are often present at the upper margin of the vomer away back. These are easily removed if mucous membrane is elevated sufficiently far back. I have seen a number of cases previously operated upon where thickenings in this region have not been removed. The region where the cartilage joins the ethmoid plate is often very thick. It is at this point where thickenings are serious, in that they here cause pressure on the middle turbinates. This part must be removed. It is dangerous to break it, for the thickening may extend further back and in twisting it off the possibility of fracturing the cribriform plate of the ethmoid must be considered. My practice has been to bite out pieces high up along the crest with a strong Jansen Middleton forceps. Then the lower part may be safely fractured and removed. Removal by biting prevents the possibility of injuring the cribriform plate of the ethmoid. At times, loose pieces of bone or cartilage may drop down between the mucous membrane layers. These can be removed by forceps or suction. They will cause thickenings if they are not removed.

The mucous membrane of the septum near the floor can be separated readily by inserting an angular elevator posteriorly where the floor is more easily reached and then pulling forward.

When there is a sharp angulation at the junction of the cartilage and vomer, the mucous membrane at this point is usually very thin and likely to tear. It is best to approach this region from below upward, as well as from above downward. The likelihood of a tear at this point should be borne in mind so that extra care is taken that no corresponding tear be produced on the opposite mucous membrane, which is usually normal or even thicker than normal. The greatest danger of perforation is in the region of the vomer and care should be taken that the mucous membrane is elevated down to the floor on both sides and that in removing the vomer, no part of the mucous membrane is caught in the instrument.

When the operation is completed, it is better not to close the incision with sutures for doing so will favor the formation of a hematoma.

If the operation has been done perfectly, without tearing the mucous membrane, there is more likelihood of a subsequent hematoma or abscess developing than if the mucous membrane has been torn. It is wise in such a case, before completing the operation, to make two incisions in the septal mucous membrane, one low down parallel to the floor, and another higher up to allow exit for any bleeding.

A light packing is all that is necessary. It allows escape of blood through the mucous membrane wound; a tight packing, by preventing egress of blood, may favor the formation of a hematoma above or in back of the limit of the packing.

Following the operation, most patients complain of headache, beginning immediately or soon after the operation. Aspirin or morphine takes care of this and the headache does not recur. In cases of fever following a submucous resection, a septal abscess will usually be found to explain it. This should be incised and watched for a few days to prevent recurrence.

In the after care of the patient, adhesions develop at times between septum and turbinates. These are best handled by actual cautery, which will prevent recurrence.

In performing a secondary submucous resection, which occasionally is necessary to remove obstructions remaining after a previous operation, of course done by some other otolaryngologist, one meets with very firm adhesions in the region of the original incision. A sharp septal knife must be employed here to prevent tearing, which will occur if a dull knife is used. It is not difficult to split without tearing the opposing mucous membranes that have united. They separate more readily than one might suppose. It is at the margins of the remaining bone or cartilage where care must be employed to prevent tearing, but if one takes his time, has good exposure, and a sharp knife, the mucous membrane can be elevated and the offending bone and cartilage removed as at an original operation.

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THE CORRECTION OF RECENT AND OLD FRACTURES OF THE NOSE.*

DR. GERARD H. COX, Glen Cove, N. Y.

The treatment of fractures of the nose has been discussed frequently at medical meetings. Perhaps for this reason such a subject does not deserve a place on a program intended for specialists of a calibre such as are found here. However, after talking with a number of my friends, I became convinced that the rhinologist sees comparatively few cases of nasal fracture in the course of a year. I hope, therefore, that a short paper summarizing the results of my experience in the large fracture service of Bellevue Hospital may prove of some interest to my coworkers in the field of otolaryngology.

The framework of the nose is composed of a bony and cartilaginous portion. The bony parts are formed by the two nasal bones, which articulate with each other in the midline, and are attached to the frontal bone above. On each side of the nasal bones we have the nasal process of the superior maxilla. In the midline is the nasal septum, partly bone (perpendicular plate of the ethmoid) and partly cartilage. The alar cartilages support the lower lateral structure of the nose.

RECENT FRACTURES OF THE NOSE.

Fractures of the nose may be divided into: 1. Fracture of the nasal bones. 2. Fracture of the nasal processes of the superior maxillae. 3. Fracture of the nasal spine. 4. Fracture of the articulation of the nasal bones with the frontal process. 5. Fracture-dislocation of the septum. 6. Tearing away of the lateral cartilages from their attachment to the bony framework.

Nasal fractures may also be classified as linear, comminuted or depressed fractures. Any of the above fractures may be simple or compound. The fracture may be compounded by a

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break in the continuity of the skin, or by a tear in the mucous membrane inside the nose, as evidenced by bleeding from the nose.

PATHOLOGY OF RECENT FRACTURES.

H. P. Mosher (*THE LARYNGOSCOPE*, Jan., 1906) has called attention to the fact that in many fractures of the nose, when the blow comes from the left, as in boxing, the nasal bones are not driven directly backward. The deformity, in such cases, is apt to be a lateral one. For example, the left nasal bone is fractured in three places: at its attachment to the nasal process of the superior maxilla, in the median line from the opposite nasal bone and from the septum, and, finally, from its junction with the frontal bone. This nasal bone, to which the force of the blow is applied, is depressed. The opposite happens to the other, or right nasal bone, which springs outward, overriding the ascending process of the superior maxilla.

In recent fractures of the nose, the deformity is often due, in large part, to depression of the nasal process of the superior maxilla, as shown in several lantern slides. Where traumatism is received by the force being applied in an anteroposterior direction, such as occurs if a man's face strikes directly against the windshield of a car, the nasal bones are driven directly backward, and have a tendency to become impacted between the nasal processes of the superior maxillae.

THE DIAGNOSIS OF RECENT FRACTURES.

The diagnosis of recent fracture of the nose is often difficult, particularly if the patient is not seen until several hours after the injury, when the soft parts may be enormously swollen and ecchymotic.

In many instances, however, as observed in some of the photographs shown, it is perfectly obvious from inspection alone that we are dealing with a fractured nose. Gentle palpitation often elicits bony crepitus and establishes the diagnosis.

In my opinion, radiographs of the nose, as a practical matter, are of secondary importance to the clinical examination, which should always include inspection of the septum with a nasal speculum. In most instances all the information

we obtain from an X-ray is the presence or absence of fracture. Dr. Frederick M. Law indorses my own viewpoint, that the X-ray usually tells us nothing about the alignment of the fragments, except in extreme deviation of the lower ends of the nasal bones.

ANESTHESIA IN RECENT FRACTURES.

On account of the trauma and contusion of the soft parts in recent fractures, it is advisable to use general anesthesia. Local anesthesia, *i.e.*, infiltration with novocain, is not usually advisable, except when a number of days have elapsed since the injury, or where the fracture is slight in extent. Certainly a bad fracture of the nose, with considerable contusion of the soft parts and bad shattering of the bones, is best reduced under general anesthesia. In this connection, I wish to give a word of caution. Do not attempt to perform the reduction under gas alone but use gas-ether, for in many instances the patient will come out of the anesthetic before the reduction is completed.

BEST TIME TO OPERATE.

Recent fractures of the nose, if seen early, should be reduced immediately, before swelling of the soft parts takes place and the normal contour of the nose and face is distorted. If not seen immediately, and the normal outlines are obscured by edema and ecchymosis, wait two or three days for the swelling to subside.

If there is a bad wound of the nose and face, which has been sutured, sometimes it may be desirable to wait eight to 10 days for the skin wound to heal before reducing the fracture.

TECHNIQUE OF REDUCTION OF RECENT FRACTURES.

My plan is as follows: Use a general anesthetic, take plenty of time, use as few instruments as possible, and do not employ any more force than is absolutely necessary. I find I can reduce the large majority of recent fractures with a small submucous periosteal elevator and my thumb. The elevator is used to raise the depressed fragments of bone, and the thumb is employed to exert pressure over the convex

side of the fractured nose to force the fragments back into the median line. Sometimes the flat handle of a nasal rasp, protected by a piece of gauze, is held over the displaced nasal bone and a sharp blow with a mallet is administered. Usually, if the external deformity is corrected, the septum snaps back into position. If not, it may be necessary to use an Asche forceps to correct the septal deformity.

IMMOBILIZATION AFTER REDUCTION OF RECENT FRACTURES.

It is difficult to lay down any rule as to immobilizing recent fractures after reduction. Sometimes the operator feels that



Fig. 1.

Fig. 2.

Fig. 1. Recent fracture; two days; traumatism — blow with a blunt instrument.

Fig. 2. Same patient after operation.

the patient will do better without a splint. In still other instances, careful immobilization is highly important. The following are the methods employed: 1. bandage rolls and adhesive plaster; 2. moulded copper or aluminum splint; 3. splint made of red dental moulding compound; 4. Joseph's splints (two types); 5. Carter's bridge splint; 6. Gillies' dental splint; 7. triangular intranasal splint of silver wire to support depressed fractures (Watson-Williams).

In any event, in bad fractures of the nose, the after-care of the patient is extremely important. Each case should be seen

every day after operation during the first week, and every second day after operation during the second week, to be certain that there is no displacement of the fragments. After a fortnight, there is fairly firm fibrous union in most instances and no further trouble need be anticipated.

If called to treat a recent nasal fracture, remember that the patient may have had one or two previous fractures, with resulting deformity. Consequently the operator cannot expect to make the nose look any better than it did before the last



Fig. 3.

Fig. 4.

Fig. 3. Recent fracture — blow from blackjack.

Fig. 4. Same patient after reduction.

accident, unless he later on undertakes some form of plastic procedure.

1. A gauze bandage roll on each side of the fractured nose, tightly held in position by straps of adhesive plaster attached to the side of the face, makes a very serviceable splint, and one which is always on hand. It is particularly useful, if tightly applied, if we wish to hold up the fragments after reduction of depressed fractures.

2. A moulded copper or aluminum splint, attached by strips of adhesive, is probably the best splint we have for plastic surgery of the nose. We employ ordinary copper sheeting,

such as is used by tinsmiths for roof-flashing, which may be bought in any hardware store or plumber's supply house. This is carefully moulded to fit the nose, the skin being protected by a layer of nonabsorbent cotton.

3. A common type of splint used by plastic surgeons is made by heating red dental compound, which is moulded to the desired shape, and attached to the nose by strips of adhesive plaster in the same way that the moulded copper splint is applied.



Fig. 5.



Fig. 6.

Fig. 5. Old lateral deformity before operation.

Fig. 6. Same patient after operation.

4. Joseph, of Berlin, has perfected a splint attached to silk bands running across the head, across the vertex and under the chin, where pressure upon the side of the nose may be applied by a long armlike attachment regulated by a thumbscrew. Joseph has also devised a second type of splint with lateral pieces connected by a thumbscrew, the whole held in place by a tape fastening about the head. This apparatus is useful where narrowing is desired.

5. Carter's bridge splint is sometimes very useful in depressed fractures.

6. The English surgeon, Gillies, during the war devised a nasal splint which is fixed to the teeth. With such an apparatus, the amount of pressure applied to the nose may be regulated exactly. These dental splints are, however, expensive to make and are not necessary in the large majority of cases of recent fracture.

7. Watson-Williams, of London, England, uses a triangular piece of silver wire, which he inserts in the nose to support the depressed nasal arch after reduction.



Fig. 7.

Fig. 8.

Fig. 7. Preoperative photograph of old depressed fracture (saddle nose) caused by traumatism received several years ago.

Fig. 8. Same patient after rib-cartilage transplant.

OLD FRACTURES OF THE NOSE.

The correction of old fractures and deformities of the nose is such a broad subject that I shall confine my remarks to a brief description of the operative treatment of two common abnormalities, *viz.*:

1. Lateral deformities.
2. Depressed fracture, or the so-called saddle nose.

For the correction of old fractures of the nose, I usually employ local anesthesia infiltration with 1 or 2 per cent novocain. If there is obstructed nasal breathing due to a bad

deviation of the septum, a submucous resection should be performed beforehand, or at the same time as the plastic operation.

While operating for lateral bony deformities, no external incision is necessary. The incision is made inside the vestibule. The periosteum and soft structures over the dorsum and sides of the nose are elevated, and the bones refractured with a saw or chisel. They are then moulded into the desired position and a copper splint or bandage rolls are applied. The splint should be changed at frequent intervals, and worn by the patient for three or four weeks to prevent thickening.

Depressed fracture (saddle nose) is also approached in much the same way. Local or general anesthesia may be used. The depression must be built up by some sort of supportive framework, the best of which is a rib-cartilage transplant taken from the patient's seventh, eighth or ninth rib on the right side. Kelly gouges, made in various sizes, are extremely useful in cutting the cartilaginous graft to the desired size and shape. After preparing the graft, a tunnel is made under the periosteum and soft parts along the depressed nasal bridge, and the cartilage is then inserted, the whole procedure being carried out through an elephant-trunk columellar incision. If one prefers, the cartilage may be inserted through an incision within the vestibule.

Where the saddle nose deformity is associated with a depressed nasal tip this is best cured by a partial submucous resection of the nasal septum, and the insertion of a vertical piece of rib-cartilage between the layers of the septal mucoperichondrium in order to raise and support the tip. This latter is in addition to the piece of cartilage already placed along the dorsum of the nose. Sometimes we use a right angle piece of rib-cartilage instead of the above mentioned procedure.

Before concluding this paper, there are one or two points which I wish to discuss. We have found that patients, particularly refracture cases, vary considerably as to the amount of ecchymosis and postoperative edema. A few days ago I performed two refracture operations for lateral deformity on two patients at Bellevue Hospital on the same afternoon.

The operative procedure was identical in each. One patient was a young, well nourished Italian girl, age 16 years. The second was a man, age 58 years, who lived in poor surroundings and who looked old for his years. A couple of days later, when making rounds, I found that the young girl had practically no postoperative swelling of the soft parts and no ecchymosis. The man, on the contrary, had considerable swelling of the soft parts, and enormous ecchymosis of the skin of the nose, upper and lower eyelids and entire face. Evidently the general nutrition of the patient and the condition of his vascular system was a factor in the production of this postoperative reaction.

Postoperative local infection, following nasal plastic operations, is an unfortunate complication. In private practice I have been singularly free from this. In the large municipal hospital where I operate and where most of the patients come from unhygienic surroundings and many are heavy drinkers and poorly nourished, postoperative local infections are sometimes encountered. Of course, when this occurs in a refracture case or rib transplant, it is apt to cause thickening or broadening of the nose. It is fortunate that a rib-cartilage transplant is peculiarly resistant to infection. Considerable suppuration may take place about the graft without destroying the cosmetic result.

All of us, I am sure, are aware of the danger involved in incising a furuncle of the lip or face. Certainly there have been far too many cases of cavernous sinus thrombosis from this minor operative procedure. I recall distinctly how one irate physician, whom I was treating conservatively for a furuncle of the vestibule, one day received me with the words, "I demand surgery." On my refusing, he promptly dismissed me from the case. In our plastic work if we get a local infection of the soft parts along the nasal bones and there is fluctuation present we promptly evacuate, usually through the vestibular incision, occasionally externally. Since Dr. Whitham took charge of the rhinoplastic service at Bellevue some two and a half years ago there has not been a single case of general infection or of thrombosis of the intracranial sinuses from postoperative infection. What is the explanation? It is difficult to say. The only factor bearing on the question which I can suggest is the following: In most nasal plastic

operations the first step is a vestibular incision and a dissection of the soft parts from the sides or dorsum of the nose. In this way we make an excellent channel for drainage, if suppuration subsequently develops. This may have something to do with preventing the development of intracranial sinus thrombosis.

Lantern slides were shown to illustrate fracture cases, as well as old traumatic deformities before and after operation.

THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC.

The Forty-first Annual Meeting of the American Laryngological, Rhinological and Otolological Society, Inc., will be held in Toronto, Canada, on June 3, 4 and 5, 1935, during the week following the meetings of the American Otolological Society, the American Laryngological Association and the American Bronchoscopic Society, in Toronto. The meeting of the American Medical Association will be held in Atlantic City, N. J., during the week following.

The scientific program is already being prepared and those Fellows who are planning to present papers should so notify the Secretary promptly. Twelve papers will be selected for presentation.

Copies of the *Transactions* for the past five years are available to those Fellows who have not already received them, without cost. Application for them should be made to the Editor of the *Transactions*, Dr. Lyman G. Richards, 319 Longwood avenue, Boston.

Will you please note the change of address of the Secretary, Dr. Robert L. Loughran, Sharon, Conn.

SOME IMPROVEMENTS IN SINUS DIAGNOSIS.*

DRS. L. WESTON OAKS, H. G. MERRILL and LLOYD E. OAKS,
Provo, Utah.

Diagnosis of nasal accessory sinus disease exemplifies a problem which, approached at first with fear and trembling, grew ridiculously easy, only to present on closer acquaintance puzzling characteristics that made it difficult of understanding. Happily, many in our specialty seem to be arriving at this third state of mind and to be honestly seeking a correct evaluation of the many phenomena observed.

For brevity's sake, we shall avoid discussing here the common routine in examination of nose and sinuses. Our purpose is to touch upon some phases related to study of that patient whose complaints naturally direct attention to the sinuses, that we feel are either usually neglected or not recognized at all.

It seems almost criminally negligent to advise operation upon the sinuses—no matter what the intranasal appearance may be—after simply hearing part of the patient's chief complaint, glancing into his nose and throat, palpating hurriedly for enlarged glands in his neck, and perhaps listening to his heart. Yet, too often is that sort of patient-study considered adequate. Then, how disturbed we feel to discover, following complete exenteration—or "block-dissection" and removal of everything in the nose—that the only benefit our patient acquired from his suffering and expenditure is a psychic satisfaction that he has had an operation. And how disconcerted we should be to learn afterward that a beginning pernicious anemia, an endocrine disturbance, a parasitic invasion of the blood stream, an allergy, or just a plain acid-alkali imbalance accounted for the patient's troubles.

True, we may find in the pathologic section "round cell infiltration" into a swollen or thickened mucous membrane,

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in view of which we can lull our scientific conscience by terming it "hyperplastic sinusitis."

There is a growing feeling that soft tissues and membranes of the nose and its related structures constitute a delicate registry—an instrument board, let us say—where many general disturbances of the body are written up in terms of nasal stuffiness, postnasal drainage, deviations in color of mucous membranes, dryness, rhinorrhea, polyposis and vague pains or headaches centering in recognized sinus areas. That these are manifestations long identified with infection of accessory nasal sinuses lends puzzling complexity to the situation, and unavoidably fastens upon us the responsibility of being always good physicians before we can hope to be even mediocre specialists in otorhinolaryngology.

Recognition of this close general relationship at once attests the need for painstaking case histories. It is not enough to ask about the presence of headache, its periodicity and location, nasal stoppage, postnasal drainage, sore throat, dizziness and any possible ear trouble. We must cover a wider range, and especially so where the patient is a woman, particularly one passing through her child-bearing years, or in the menopause. Endocrine imbalance, which is of mild degree so far as characteristic symptoms go, not infrequently manifests turgescence of nasal tissues, postnasal drainage and headache. When these complaints are coupled with menstrual disturbance, alteration in function of pelvic structures, pregnancy, insomnia, or some enlargement of thyroid gland, the possibility of endocrine origin of nasal complaints is at least strongly suggested. The writer saw in consultation a woman, age 47 years, who had been for a week bedridden because of headache. The pain had grown steadily worse day by day, until during the past two days and nights, she had been in excruciating agony and vomiting almost constantly. Her nasal tissues were swollen and red. There was some postnasal drainage, with considerable tenderness under the right brow, where she said her pain was at times most severe. From the history it was learned that her menses had been entirely absent for four years, although biologically she looked to be at least several years younger than her stated age. Despite the fact that one-fourth grain of morphin given hypodermically a few hours before had brought no relief, a single

ampoule of whole ovary by hypodermic injection stopped the headache and vomiting within two hours, and repeated daily, allowed complete recovery from symptoms.

In hyperthyroidism an intense redness, dryness and swelling of intranasal tissues may lead an unwary observer into the serious mistake of considering the headache and other symptoms which accompany it as due to sinus disease.

Or the *slightly* pallid, wet, rather swollen, sluggish-appearing membranes, with clinging shreds and flecks of what appears to be mucopus may centralize one's impressions upon local disturbances to the ignoring of a causative hypothyroidism.

Later months of pregnancy are frequently accompanied by bitter complaint of nasal stoppage which is most intense at night. Here appearance of nasal tissues seems to vary, being perhaps more often red and wet. Frequent use of ephedrine in such a nose seems to give relatively little relief, and probably does do harm. Endocrine therapy and proper control of acid-alkali balance offer much more direct and lasting help.

Early disturbance of physiology incident to prodromes of the menopause not only aggravate and emphasize any existing sinus disease, but frequently register a symptom complex simulating it. Naturally, surgical action upon such a mistaken diagnosis is a serious faux pas, which brings little glory to the surgeon and scant comfort to the already unhappy patient.

Pelvic disease, in women, is occasionally associated with nasal symptoms that may readily be attributed to infection of the sinuses. Young individuals who have undergone hysterectomy and oophorectomy not infrequently show such a symptom complex, and some form of endocrine therapy is the only means of ready relief to them. So, too, with the woman of inadequate development in pelvic structures, as shown by infantile uterus and such other deviations from the average normal as usually accompany it.

The history should include some inquiry as to an individual's habits of work. This is well illustrated in the case of a young man who complained of headache, nasal obstruction, postnasal

drainage, an almost continual feeling of fatigue and restless nights. He was certain that he had a very bad case of sinus trouble, but careful study failed to discover any pathology in his nose or sinuses. His nasal condition was one of engorgement and turgescence, with red, wet, mucous membranes and not much else. Questioning brought out the fact that he was working long and irregular hours, seven days a week, had been given no vacation in four or five years, and was yet receiving so small a salary that he, his wife and baby could scarcely subsist upon it. In addition, he was studying each evening in a determined effort to fit himself for a better job, then tossing all night in subconscious anxiety over trying problems in his mental work. His trouble was one of fatigue, yet there was sufficient disturbance in nasal physiology that he might have been thought a case of hyperplastic sinusitis, who was absorbing sufficient poison from the infection to cause his "run down condition."

Especially is this true where Roentgenograms are allowed to furnish preponderant and deciding testimony in favor of surgery. It is well known that mucous membranes of the sinuses are subject to the same influences inducing turgescence in the nose. Yet we seem to go on feeling that any sinus showing a thickened lining membrane should be operated on. X-ray is properly, here as elsewhere, an adjunct in the diagnosis and should not be permitted to decide the issue against other less dramatic but more vital findings.

Inspection of the nose is of great importance, but the casual look which sees only a crook in the septum, pus from under middle turbinates, hyperplasia of an inferior turbinate, polyps or nothing worth noting is insufficient in modern rhinology. Pallid, edematous, wet membranes in nasal stoppage of recent beginning denotes, besides hay fever, a possible alkalosis and such a patient will usually admit having used citrous fruits or alkalies very heavily in "trying to get rid of a cold" or perhaps to prevent one.

Jarvis¹ and others have said much about the "red septum" and there is undoubtedly something of decided value in their observations, although most of us do not find as much as they do. Intense redness of lining membranes in the nose, however, is of significance as suggesting deficiency in the alkali

reserve. Whether it is possible for acidosis to occur in a circumscribed area such as the nose we do not know, but it is demonstrable that the raw, burning sensation often complained of in postnasal and epipharyngeal regions may be promptly relieved as a rule by a single dose of alkali internally.

Cyanosis of both inferior turbinates, in a child, seems to accompany avitaminosis for A and D. At least, a normal color will return after codliver oil therapy is gotten under way. In adults this blueness of inferior turbinate mucosa on one side is occasionally seen in acute conditions, and seems there to denote the presence of pus or toxic secretions in the corresponding maxillary sinus.

Marked pallor of middle turbinate and immediate surroundings, with remainder of nasal tissues normal in coloration, or even red, has been observed many times, but we have been unable to discover its significance. The appearance is often striking. It has been observed to involve one middle turbinate and the distal portion of a shelf-like septal spur, while all other nasal membranes were at least normally red.

Cytology of nasal smears has been receiving more attention of late. Johnson and Goldstein² offer some interesting suggestions in its use for discovery of allergy. They find that only the allergic patient who has had symptoms over a period of months will show the commonly described pale and boggy mucosa of allergy, while in cases of shorter duration the nasal tissues may present any color variation from pallor to normal, and even deepest red with injection.

From our specialty the study of allergy seems barely in its infancy. That hypersensitivity to foods, emanations, clothing materials, environment and other contacts plays a major part in the practice of rhinology must be brought home to us. It would appear much more logical for a specialist in rhinolaryngology to be his own allergist than to do Roentgenology, still very few of us are yet aware of its dawning importance in our field.

Bacteriology in accessory nasal sinus disease has received sporadic attention from widely scattered observers for at least 40 years.³ Yet it has been accorded little or no importance in routine clinical work. Washing out of maxillary, sphenoid

and even of frontal sinuses has been widely used as an aid in diagnosis, usually with the motive of discovering the presence of pus there. Numerous writers have stated—and all of us have demonstrated many times—that return of clear lavage fluid from a sinus is in no sense conclusive of absence of disease from the cavity. Most of us have done such washings and had the patient's symptoms improve markedly, even though no macroscopic evidence of infection was found.

Jenssen,⁴ Balmer⁵ and others have concluded that normal sinuses are sterile. In substantiation of this, we have found one or both maxillary sinuses sterile in 234 of 475 patients who came because of what they presumed was sinus infection. This was part of a systematic study to be published later as to the feasibility and importance of investigating sinus bacteriology. Contrary to the conclusions offered by such observers as Jenssen⁴ and Kyle⁵ that there is no characteristic bacteriology of the sinuses, we believe there not only is a characteristic bacteriology, but that it is of great importance in determining proper treatment for a given case.

Most of us have scored from time to time at least a few failures in our nasal surgery cases and have puzzled over why each of them failed to get the brilliant satisfaction obtained by others cared for in the same manner. Many have been considered as incompletely operated on and have been subjected to further surgery—often again and again—with indifferent or no results. In the end are left patients who either blame the doctor for bungling work or hold nasal surgery to be a hopeless failure in every case. Our erstwhile colleague, the family doctor, has seen so much of this that he, too, has come to believe there is no virtue in nose operations, and so advises his patients in vigorous terms.

Meanwhile the rhinologist has an uneasy feeling that something was wrong in each of these particular instances and hopes not to meet the victims too often. Asked about it, he camouflages his inadequacy by labelling the person a "neurotic."

The writers believe the term "neurotic" belongs in the same limbo with "catarrh," "neuralgia" and "rheumatism," as used in their old-time generic application. In other words, that a "neurotic" individual is made so by the surgeon who

first operates upon that person in consummation of a carelessly made and inadequate diagnostic study. Especially does this seem applicable in that field of increasingly complex physiology, the nose and its accessory sinuses.

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THE AMERICAN BOARD OF OTOLARYNGOLOGY.

During 1935, examinations will be held in New York City, June 8, in connection with the meeting of the American Medical Association, and in Cincinnati in the Fall, during the meeting of the American Academy of Ophthalmology and Otolaryngology. Prospective applicants for certificate should address the Secretary, Dr. W. P. Wherry, 1500 Medical Arts building, Omaha, Neb., for application blanks.

MUCOCELES OF THE FRONTAL SINUS.*

DR. JOHN A. CAVANAUGH, Chicago.

Much has been written upon mucocèles, but I have gleaned nothing from the earliest case report, to the present, which has thrown light upon the occurrence of this malady.

I believe there should be opinions more positive as to the cause of this condition. It appears that each writer continues to express the opinion of the primordial writers, and ceases to look further for the causative factors.

Dr. D. Braden Kyle, in his text of 1899, states: "Condition arises as result of prolonged catarrhal inflammation within the sinus whereby there is either a formation of myxomatous masses, a mucoïd degeneration of the investing membrane or proliferation of mucous cysts. Through the growth of these elements there is developed a mass, retained by a thin membrane and consisting largely or entirely, of the elements constituting normal mucous."

Bosworth text of 1898: "In frontal disease bulging of the orbital plates is not a rare event, but in this case the eye is able to be crowded downward and outward so that the eyeball is not protruded to the same extent as is liable to occur in ethmoid disease. Diplopia, when present, is the result of displacement of the eyeball and therefore constitutes a diagnostic sign of no additional value."

St. Clair Thomson text, 1912: "A mucocèle is a distension of one or more walls of an accessory sinus and an accumulation within it of a mucous secretion. This secretion may be located in one part of the sinus and may become purulent. It is usually associated with more or less complete obstruction in the outlet of the cavity and it may be caused by blockage of cystic dilatation of a gland. Mucocèles are met most often in the frontal sinus and the ethmoid labyrinth. The old view of this condition was that it was

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due to catarrh of the mucous membrane and that when the exit of this secretion was obstructed, it accumulated and distended the cavity. The mucocèles are much more likely to be caused by the development of cysts in the mucous membrane, either by cystic dilatation of a gland or the cystic degeneration of a polypus. The cyst may then grow to such a size that it occupies the sinus and is mistaken for its cavity. The cyst wall may rupture and the fluid become free. There is a chronic inflammatory process in the lining mucous and in the subadjacent bone which sometimes undergoes erosion and absorption."

Jackson-Coates text of 1929: "This rather unusual phenomenon is characterized by a slowly increasing swelling in the sinuses causing obstruction in the nose or external swelling. It does not produce the usual signs of inflammation and is more apt to be mistaken for a new growth. Its most common situation is in the anterior ethmoid and frontal, and usually produces an external swelling above the inner canthus."

Patrick Watson Williams text, London, 1910: "Mucocèles or bony cysts are fairly common in ethmoid labyrinth, especially with the middle turbinate bone. Ethmoid mucocèles are due to progressive distension of one or more cells from the pressure of retained secretion owing to more or less complete and prolonged obstruction of their ostia. Probably frontal sinus mucocèles are originated in this manner. In rare instances, clinically a bone cyst, the cavity contains nothing but air. Such cysts are either mucocèles from which fluid contents has escaped or are examples of over-development of otherwise normal cavities."

Ballenger text: "There are two factors, a cystic degeneration and ostium occlusion, necessary to the development of the mucocèle. A cyst may grow until it fills the cavity of a sinus without producing a mucocèle as long as the ostium remains patent. Similarly occluding of the ostium without a tendency to cystic degeneration of the mucosa will not cause a genuine mucocèle."

I believe frontal mucocèles are the result of misplaced ethmoid cells with an absorption of its bony walls and are not recognized as such unless a hyperplastic tissue change takes

place or an infection, causing a pyocele. It is not uncommon to see one or two ethmoid cells develop into the frontal sinus which Schaeffer calls frontal bullae cells. The mucocoele cell being a later development.

Dorland's definition of a mucocoele is: "A nasal retention cyst; also a mucous polypus." I think this an inadequate definition and in no way clarifies our understanding of a frontal mucocoele. I believe a more pertinent explanation would be "a misplaced ethmoid cell which becomes a mucocoele due to some vitamin or endocrine unbalance."

Etiology: Extremes of temperature, climate, seasons or altitude, as far as we know, play no part in this condition. Male and female seem to be equally affected. Age appears to play some part, for mucocoeles occur usually after childhood. H. C. Rosenberger and C. E. Kinney, of Cleveland, in *Archives of Oto-laryngology*, April, 1931, report a case, age 13 years, which they claim to be younger by several years than any case mentioned in the literature reviewed. They state that the etiology is by no means established. Their two most plausible explanations are: 1. It is due to enlargement of a minute retention cyst of one or more mucous glands often seen in a routine examination of lining membrane removed at operation. 2. It is due to closure of nasofrontal duct from trauma, obstruction, inflammation; and why this condition is practically never seen in the other nasal sinuses is a question. They think possibly the explanation lies in the fact that the condition is otherwise diagnosed when it involves other sinuses."

William B. Chamberlin and Thayer L. Perry, in the *Archives of Oto-laryngology*, August, 1933, report six cases, ages 12 to 42 years. Race, social conditions and heredity play no apparent part. Toxic agents, dust, fumes, vapors and gases may predispose to these conditions. Just what effect disorders of metabolism may have is uncertain, but I verily believe they have much to do in this condition. Trauma, according to most writers, is a most potent factor, yet I am skeptical as to this view. If it is such an important factor, there would be many more mucocoeles. Bacteria seem to have no share in this condition. Up to the present we can but conjecture, one guess is as good as another.

Symptoms: The period of incubation is unknown and the symptoms during this period would be indefinite. The objective symptoms usually present are, swelling at the inner third of the roof of the orbit which may extend along the entire upper lid. The displacement of the eyeball, which will vary as to the size of the swelling. Epiphoria is occasionally observed and complained of. The skin over the swelling is unaltered, unless infection finds its way into the cavity and then it becomes red, tender and forms a pyocoele. On palpation the swelling is soft, elastic or semi-fluctuating, sometimes transmitting a sensation like that of an eggshell crackling under the finger. At times a bony edge, around the mass, can be felt if the bone has been absorbed.

The eyeball, in many cases, is displaced forward, downward and outward, and its movements are seldom altered. The nasal cavity may or may not show pathology and seldom, if ever, shows anything that would spell mucocele. The disfigurement, in some cases, is very noticeable. When the patient is in the erect position the swelling is more marked. Fever is absent. Fundus seldom altered.

Subjective symptoms are varied. There are frequent complaints of diplopia. Pain is rarely present.

Laboratory Findings: Blood usually negative, unless luetic. Secretion from the nose may or may not be complained of, and has no special significance.

Diagnosis: Is not always simple and Dr. Louis Daily, of Houston, Tex., in the *Annals of 1926*, states: "Mistaken diagnosis is not uncommon. Sarcoma, osteoma or new growths, being suspected." Dr. Clyde A. Heatly, of Rochester, N. Y., states: "Mucocoeles are usually easily diagnosed, but occasionally osteoma and fibrosarcoma are confusing. Sometimes what appears to be mucocoele is malignant. A cystic lacrimal sac, sebaceous cysts, meningocele and dermoids may simulate mucocoele.

Jackson-Coates say it may be difficult to distinguish a mucocele from a new growth and such mistakes have occurred. A needle puncture will determine the presence of fluid in the mucocele. I do not think it is always possible to make a positive diagnosis by a needle puncture. X-ray findings are sometimes indefinite. Complications are practically nil.

Treatment: I believe prophylaxis might play a part, if we but knew the reason for such changes. When these tumors are recognized, surgery is the only sure procedure. Killian or some of its modifications.

Following is report of case: E. F., female, single, white, age 19 years. Admitted to my service at the Illinois Eye and Ear Infirmary.

Previous History: Noticed during fall of 1932, eyes were red, swollen and ached. Kept them closed as much as possible because they felt better. Lights hurt them. In December was given glasses by an optical company and was told her eyes would heal in 30 days. Instead, gradually grew worse. Consulted several doctors with little relief. Was told she had sinus trouble and on April 10, 1933, both maxillary sinuses were opened and patient states they were infected. Felt some better until September, when left eye began to get red and some swelling and aching. A little later noticed eye began to push out and doctor said he didn't know what was wrong.

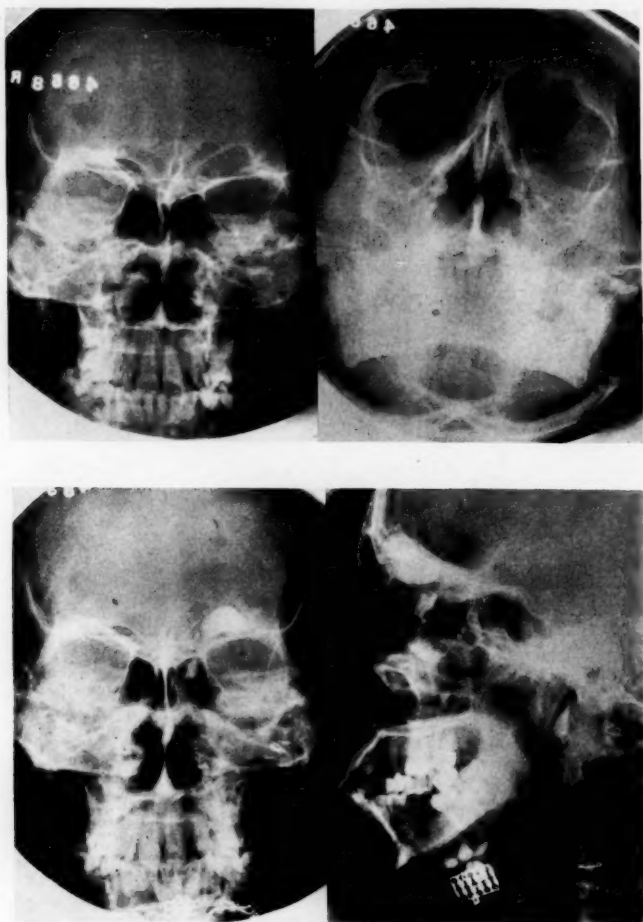
Findings: Temperature, 98.4°; pulse, 80; respiration, 20. Blood count: Red cells, 4,200,000; whites, 8300; hemoglobin, 72 per cent. Urinalysis, negative. Wassermann, negative.

Tonsils removed.

Nose: Septum deflected to right. Nasal antrum openings found under inferior turbinates. Some mucopus in both antrums. Left middle turbinate hangs out against septum away from lateral wall. There were no intranasal findings indicating frontal sinus infection.

X-ray Findings: Various positions were taken as well as stereos. All of which showed very little, if any, definite findings. The posteroanterior view showed some variations on the mucocele side, but no evidence of bone absorption. A radiopaque solution of brominol was injected into the frontal sinus by a catheter introduced through the nasofrontal duct, the pictures showing rather a small cavity filled with the radiopaque solution in about the middle of the frontal sinus with a small budding extension below. I take this opaque area to be a frontal bullae, the bone having been absorbed, leaving only the membranous sac.

Patient was referred to Dr. Von der Heydt's service for ophthalmologic examination for the determination of a pos-



Brominol injection.

sible ocular cause for her exophthalmos. Dr. Francis M. Cragg took charge and gave the following report: At the

time her complaints were, bulging of the left eye and left sided headaches. The vision, as recorded, was: R. E., 18/200; L. E., 10/200; with glasses: R. E., 20/30; L. E., 20/50.

She was wearing a -2.00 sphere in each eye. The right fundus was normal. The left displayed horizontal retinal folds at the macula (pressure). On inspection a moderately marked degree of exophthalmos of the left eye was noted. The palpebral fissure was slightly wider than that of the right. Local and regional signs of acute inflammation were absent. Palpation revealed the presence of an irregular semi-boggy globular mass under the upper orbital margin, medial to the location of the lacrimal gland. How far back the mass extended could not be determined. The mass was tender to deep pressure. The exophthalmos was reducible and there was no bruit.

The ocular movements were not restricted. Prior to operation the patient never complained of diplopia. Objectively with both eyes free, at $1\frac{1}{2}$ meters, no diplopia could be elicited with the spot of light as a test object, but with the red glass over one eye the patient, at repeated examinations, consistently described a vertical diplopia in all fields, with slightly greater separation down the left, the upper image always belonging to the left eye and a lateral diplopia, homonymous in character, with greatest separation with eyes right and down and right. The latter findings seemed to indicate the presence of a paralysis of a secondary abductor. The findings in the vertical double images showed so much similarity in all fields that a definite diagnosis as to the specific muscle involved in the vertical imbalance could not be accurately made.

For the next two months the patient was regularly examined. A record was kept of the vision, degree of exophthalmos and diplopia fields. The vision of the right eye averaged 20/100 with slight variation; that of the left eye averaged 20/100, as acute at one sitting as 20/40. As myopes generally do, this patient may have squinted to obtain the last mentioned reading. The exophthalmometer reading was rather constant, averaging $H=19.35$ with slight fluctuation

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The diplopia tests remained as heretofore described.

This exophthalmos represented an ocular sign which, associated with a wrinkled retina, a fairly stationary vision and extraocular muscle imbalance, warranted a diagnosis of some lesion of extraocular origin.

Tenonitis, orbital abscess and cavernous sinus thrombosis were ruled out, as signs of an acute inflammatory process were wanting.

Basedows disease was ruled out because of infrequent occurrence of unilateral exophthalmos in that disease and because the other cardinal symptoms were not present in this case.

Optic nerve neoplasm, although it in many instances follows a rather slow course, should by this time have shown greater deterioration in vision and papilloedema, if one were present here.

Pseudo tumors of the orbital cavity, chronic inflammatory processes and "slow growing" extrabulbar tumors could not be completely eliminated from consideration. However, with such a lack of restriction in the ocular movements, the duration of the exophthalmos and the negative B. W. and Von Pirquet, it seemed proper in this case to reduce such an incidence to a bare possibility.

There was nothing here which resembled an angioma.

Following the operation on the left frontal sinus, the exophthalmos promptly regressed. The last exophthalmometer reading, taken on March 23 last, was $H=17-18$.

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On Jan. 31, 1934, an external operation was performed by Dr. George Woodruff and myself. The technique followed was that of Lynch. The greater portion of the floor of the frontal sinus was absent and where the incision was made it opened into it. A thick greenish fluid was expelled from the cavity. The greenish cast, we decided, was due to the brominol which had been injected for X-ray definition. There were granulations in the recesses which, with the entire mucous membrane of the cavity, were removed. The naso-frontal duct was enlarged and a rubber tube was inserted from frontal sinus into nasal cavity and allowed to remain

for two weeks. No irrigations were used and patient made an uneventful recovery.

Cultures made from the mucous membrane showed no growth. Histological examination of mucous membrane showed an edematous mucous membrane with round cell infiltration.

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**GRADENIGO SYNDROME AND SUPPURATION OF
CEREBRAL VENTRICLES AS COMPLICATIONS
OF ACUTE SUPPURATIVE OTITIS MEDIA.
(REPORT OF CASE WITH AUTOPSY
FINDINGS).***

**DR. EDWARD K. MITCHELL AND DR. ALEXANDER SILVERSTEIN,
Philadelphia.**

Among the complications of acute suppurative otitis media that have been analyzed and discussed by numerous writers, the extension of the infection to the tip of the petrous pyramid and to the intracranial structures has received the greatest treatment. Of particular interest is the so-called Gradenigo syndrome, which is thought to be due to a circumscribed serous leptomeningitis, presumably resulting from an infection of the apical cells in the petrous pyramid and which is supposed to produce a definite clinical picture of trifacial pain and abducens paralysis on the side of the otitis media. Since the description of this syndrome by Gradenigo in 1904, it has been found that many cases recover, whereas others go on to a fatal meningitis.

In the recent literature, particularly through the works of Profant,¹ Eagleton² and Almour and Kopetzky,³ much knowledge has been gained as to the clinical picture of the petrous tip involvement and, what is even of greater importance, the descriptions of various technical surgical measures, which these writers claim should bring about recovery in many cases where the patients would otherwise succumb to this complication. It is now recognized by the various authors that the complete Gradenigo syndrome is relatively rare in infection of the apex of the petrous pyramid. Profant's explanation for this incomplete syndrome is, that the cells in the petron do not extend to the extreme tip and that the distance of the trigeminal canal is 10 mm. shorter than to the

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abducens canal; thus, the usual presence of the trigeminal pain and the infrequent evidence of Vth nerve weakness.

The most recent work on this problem has been done by Kopetzky and Almour. In a number of publications, these authors formulate a definite clinical symptom-complex of supuration of the tip of the petrous pyramid characterized by: 1. severe ocular pain, which is deep seated and is felt within the orbit and at the onset is nocturnal in character; 2. persistent, aural discharge following operation, or the sudden reappearance of a discharge from the ear after a period of a dry ear; 3. the Roentgen examination showing a loss of trabeculation and pathological changes in the pyramidal apex occurring in pneumatized petrous pyramid; and 4. the presence of a low grade sepsis, transient facial paralysis, nystagmus, all of which help to corroborate the diagnosis. Kopetzky makes a distinction between this specific lesion and osteomyelitis of the petrous pyramid. He claims the pathological process in the former is due to an osteitis, resulting in an encapsulated empyema with frank pus formation and can only occur in pneumatized bone, while, in contrast to this, osteomyelitis of the petrous pyramid is present in diploic bone. Although the clinical picture may be very similar in both conditions, the treatment is entirely different. Kopetzky and Almour describe a technical surgical procedure for the drainage of pus from the apex of the petrous pyramid, which they emphasize is only indicated in their described clinical entity.

Our purpose in reporting the following case is to first point out the resemblance of the clinical picture to the syndrome of petrous tip involvement as described by the various authors in recent literature, and, secondly, to correlate the clinical picture with the pathological findings of the affected petrous pyramid and, particularly, to attempt a differentiation of the findings in our case from the more specific syndromes of petrous tip infection as described by the various authors.

Report of Case: J. F., white female, age 12 years, complained of pain in the right ear. On the following day a myringotomy was performed and a bloody, mucopurulent discharge was obtained. The pain and mucopurulent discharge persisted for 10 days at which time the patient was admitted to the Temple University Hospital on Oct. 30, 1931. The fam-

ily and patient's past history had no bearing on the present illness.

Physical examination at the time of admission to the hospital showed the patient to have an acute purulent mastoiditis, as evidenced by a profuse mucopurulent discharge from the right middle ear, slight drooping of the posterior superior canal wall, tenderness over the mastoid tip and emissary veins, associated with edema over the mastoid. The remainder of the physical examination was negative. The temperature, pulse and respirations were slightly elevated, the urine was negative and a blood count showed a slight secondary anemia with a leukocytosis (12,800 W.B.C.), polymorphonuclear cells predominating (76 per cent).

A right simple mastoidectomy was performed under avertin and ether analgesia and a hemorrhagic type of mastoiditis with free pus and necrosis above and behind the antrum was disclosed. A culture and smear were taken and later showed the organism to be the streptococcus hemolyticus. For the first five days following operation, the patient ran a usual course, the temperature being slightly elevated. On the sixth, seventh, eighth and ninth postoperative days there was considerable elevation in temperature and a blood transfusion was performed, 210 cc. of whole blood being given the patient by direct method. Following the transfusion there was a tendency for the temperature to subside and, on the twelfth postoperative day, it reached normal, only to rebound on the following day. The patient was again transfused, receiving 360 cc. of whole blood. The temperature immediately returned to normal, thereafter ranging between 98° and 100° and, on the twenty-fourth postoperative day, the patient was discharged. The wound was dressed daily starting with the first postoperative day and was kept open until the time of the patient's discharge from the hospital, at which time it was draining slightly.

While in the hospital we observed the patient desired the room darkened but at that time we felt this was of no significance, owing to her good clinical appearance. Seven blood cultures were taken, six of which showed no bacterial growth, one showing a growth of staphylococcus albus. While at home the mastoid wound healed entirely and the middle ear remained dry.

One week following discharge from the hospital, the patient was readmitted, Nov. 29, 1931, complaining of right frontal headache. The temperature, pulse and respirations were slightly elevated. The right ear was found to be dry and the mastoid wound healed, although slight tenderness was present over the tip. There was pain in the first division of the Vth nerve, with a mild VIth nerve palsy on the right side; a group of symptoms that was interpreted as Gradenigo's syndrome.

Eye examination showed a smaller palpebral fissure on the right. The optic discs were hazy, with sharply defined margins. The urine was negative. A blood count showed slight secondary anemia and a leukocytosis (12,000 W.B.C.), with 72 per cent polymorphonuclear leukocytes. X-ray of the right temporal bone showed a few cells in the right mastoid, decalcification in the apex of the right petron. X-ray of the sinuses revealed an absent right frontal sinus and decrease in the air content of the right ethmoids.

On the second day following the patient's readmission, a secondary mastoid operation was performed, at which time granulation tissue and a few small cells in the zygomatic area were removed, as well as a few at the tip. The tegmen antri was removed, exposing the dura of the middle cranial fossa, which was found to be normal in appearance. The first 15 postoperative days (following second operation, about 30 days after the first operation) were uneventful and it appeared that the patient was very much improved clinically, the temperature, pulse and respirations being about normal. On the sixteenth day following the second operation, the patient complained of severe supraorbital pain and shortly afterwards there was a chill, followed by a sharp rise in temperature, pulse rate and respirations. There was very marked nuchal rigidity and positive Kernig sign bilaterally, with an extreme degree of external right rectus paresis. The heart and lungs were negative. The patient began vomiting incessantly. The white cell count had risen from 7,500, with 75 per cent polymorphonuclear leukocytes, to 23,750, with 74 per cent polymorphonuclear leukocytes. The Shilling index, 17 days after the second operation, showed: Myelocytes, 0; juveniles, 3; stab., 1; segmented, 80; small lymph., 13; large lymph, 2; mono., 0; trans., 0; eosin., 1; baso., 0. Lumbar

puncture showed the spinal fluid to be slightly cloudy and under a pressure of 8 mm. of mercury. This fluid contained 660 W.B.C. per cm., with 90 per cent polymorphonuclear leukocytes. Culture and smear were negative. Blood culture was also negative. The temperature was remittent in type and, on the eighteenth day after the second operation, the patient received 210 cc. of whole blood by direct transfusion. A right myringotomy revealed no evidence of pus or other collection in the middle ear. The child remained mentally clear.

The neurological signs suggested meningeal involvement; the absence of organisms was against the diagnosis of true meningitis. The chlorides in the spinal fluid were found to be diminished (590); this, together with a positive Levinson test on several occasions, suggested the diagnosis of a tuberculous meningitis. On the nineteenth day both retinae were found to be hyperemic. Blood sedimentation showed steep drop. Chest was negative; the wound was clean and not discharging; the temperature remittent in type. On the twentieth postoperative day the patient had a second chill, followed by a marked rise in temperature, and complained of headache. Nuchal rigidity, photophobia and right external rectus palsy were marked, with the presence of a bilateral Kernig sign. On account of the chills and temperature curve the possibility of a sinus thrombosis was considered. A Tobey-Queckenstadt test did not reveal any evidence of block.

On the twenty-second postoperative day the patient was again taken to the operating room, lateral sinus exposed, punctured and free blood obtained. The cerebral dura was further exposed, found to be normal in appearance, incised, locating no abscess. The patient was also given 200 cc. of blood by direct transfusion. During this time, and up until the twenty-sixth day, the spinal fluid pressure varied between 20 and 26 mm. of pressure. On the evening of the twenty-sixth day, the spinal fluid pressure fell to 4 mm. and only 4 cc. of yellowish turbid fluid could be removed. The pupils were widely dilated; there was beginning papilloedema of the discs. The spinal fluid culture, which did not reveal any organisms up until this time, now showed a streptococcus pyogenus.

On the twenty-ninth postoperative day the neurological findings showed nystagmus in the vertical and lateral planes,

tremors of both upper limbs, the reflexes in the upper extremities were hyperactive, with a positive Hoffman sign on the right and an increase of the right patellar reflex, ankle clonus, together with positive Oppenheim and Babinski signs. On this day, the right temporal lobe and right cerebellar hemisphere were probed but no pathology was found.

Examination of the spinal fluid bacteriologically and the inoculation of a guinea pig failed to reveal the tubercle bacillus. Repeated examinations of the spinal fluid for chlorides showed a progressive diminution as low as 410. On the thirtieth postoperative day X-ray of the chest suggested a right bronchopneumonia with a possibility of miliary tuberculosis.

On the thirty-eighth day the patient became stuporous. The child continued to develop all kinds of neurological signs, such as peripheral facial palsy on the right side, a complete flaccid paralysis of the right upper extremity and a paralysis of the left lower extremity, both of the central type. There was evidence of cortical irritation on both sides of the body. On the thirty-ninth day, when the clinical neurological picture was far advanced, the spinal fluid was practically clear, with only 240 W.B.C., and the spinal fluid chlorides rose from 410 to 490. On the forty-second day the patient died. Throughout the second admission, the patient received, on various occasions, antimeningococci serum intraspinally and intravenously, neutral acriflavine, Pregl's iodine and 50 per cent glucose intravenously.

Pathological Examination of Brain by Dr. N. W. Winkelman — Gross Examination: The brain is rather soft and slightly edematous and shows a great deal of congestion. There is visible, even without sectioning of the brain, evidences that there is a great deal of internal hydrocephalus, as shown by the collapse of the temporal lobe and bulging of the third ventricle. There is a very focal greenish exudate around the anterior surface of the pons, medulla, angles bilaterally and extending over the anterior surface of the cerebellum. This has completely obscured the anatomic structures of this area and has included in its territory the IVth, Vth, VIth, VIIth, VIIIth, IXth, Xth, XIth and XIIth cranial nerves.

A section through the midbrain in its lower portion shows that the aqueduct is filled with pus. Section through the

medulla shows a collection of greenish pus in the fourth ventricle and going out through the foramen of Luschka, apparently the entire collection, however, being restrained by the collection of pus in this area. On frontal section of the brain there is marked internal hydrocephalus and it is completely filled with a pyogenic exudate, which is greenish in color.

Gross Diagnosis: 1. Basal meningitis; 2. intraventricular abscess.

Microscopic Examination of Brain: The entire subarachnoid space and ventricles are filled with an exudate that is most tense. For the most part it consists of numerous polynuclear elements, many of which show degenerative manifestations. Around the margins of the nervous tissue, two types of cellular elements are found as evidences of the chronicity of the process; one is the small lymphocyte and the other the plasma cell, the latter being in greater abundance. Invasion of the tissue here and there has occurred with degenerative evidences as the presence of numerous gitter cells. Many of the marginal areas show invasion by the inflammatory process; for example, in the cerebellum some of the folio and plasma cells. The large blood vessels at the base showed a beginning atheroma. The ventricular areas were much more involved than the subarachnoid. The cortex shows a tremendous involvement, with numerous rod cells.

Microscopic Diagnosis: Meningoencephalitis, subacute.

Microscopic Description of Petrous Portion of Temporal Bone by Dr. Konzelman: Examination of cross-section of the petron nowhere reveals extensive bone destruction. It is noteworthy that on both the right and left sides between the spicules of bone there is marrow of varying structure. In some places it is chiefly a loose network of fibres, supporting a few cells and a number of engorged capillaries. In a few there is nothing but fat. On the right side several spaces are seen in one of the sections taken at various levels where there are large numbers of mononucleated cells, including many macroblasts and eosinophiles. Corresponding areas are not seen in the left petron; that is, on the sound side. In several instances, very cellular areas are noted, but the cells are limited to the perivascular spaces. These are nearly all

of the myeloid type; many possess round nuclei, a few show beginning segmentation. Eosinophiles are entirely absent and megaloblasts are rare. In several patches, where the basis seems to have been a fatty marrow with very little connective tissue, large numbers of cells are seen, many of which possess segmented nuclei, but the majority of which possess large round nuclei. Here, too, there are a few megaloblasts. Where the tissue is less dense in this patch, there seems to be disintegration of the supportive stroma.

Diagnosis: Low grade chronic osteomyelitis.

COMMENTS.

The diagnosis of the clinical picture prior to the onset of the chills and fever resolved itself into one of three possibilities: 1. An empyema of the tip of the petrous pyramid, the specific lesion described by Kopetzky and Almour; 2. an osteomyelitis of the petrous pyramid described by Eagleton, and 3. a complicating Gradenigo syndrome due to a mild infection of the petrous tip (petrositis), which often improves with conservative measures. Of these three, we were inclined to favor the third. The appearance of a Vth and VIth nerve involvement following the first mastoid operation, that is, the Gradenigo syndrome, was interpreted as due to a focal meningeal involvement secondary to a mild infection in the apex of the petrous pyramid.

In finding some tenderness of the mastoid tip and the presence of a slight temperature in association with the cranial nerve disturbance, together with a blood picture of a leukocytosis, it was felt that a secondary operation on the mastoid with the removal of other foci, if present, was indicated. Following this second operation, the patient's recovery was practically complete and her discharge from the hospital was strongly considered. During this "quiescent" period, the temperature was normal, the leukocytosis disappeared and the white blood count was normal. With the sudden onset of chills and fever, indicating a blood stream invasion, and the appearance of the meningeal signs pointing to the extension of the process to the leptomeninges, the prognosis seemed indeed poor.

In view of the fatal outcome this question arose: Were we justified in our method of handling this case? There were

those who felt that we were dealing with a case of suppuration of the petrous pyramid, which called for the Kopetzky and Almour surgical technique, who pointed out that the "quiescent" period in our patient had been explained by Kopetzky, who strongly emphasized this period of freedom from symptoms as dangerous and misleading, and only to be followed by fatal meningitis. We maintained, however, that in Kopetzky and Almour's cases an essential symptom was the persistence of the aural discharge, and further stressed that the specific lesion which these authors describe can only occur in pneumatized petrous pyramids, since it is claimed that this cellular type of bone coalesces and produces frank pus. In our patient one of the outstanding characteristics in the clinical picture was the cessation of aural discharge following the first mastoid operation and the absence of any discharge from the middle ear and operative wound throughout the entire clinical course. The dry ear, together with the Roentgen findings of nonpneumatization, we felt, ruled out empyema of the petrous pyramid.

The second possibility of osteomyelitis of the petrous pyramid in the sense of Eagleton, we considered. However, in view of the dry ear, the rather prompt relief of symptoms and improvement in the clinical picture, and the normal white count following the mastoid operation, we felt, that Eagleton's major operative procedure in unlocking the petrous pyramid was not indicated.

In treating our patient along conservative lines, we had in mind that the Gradenigo syndrome is a complication that frequently disappears with such measures. With the unexpected sudden appearance of chills and fever, with meningeal signs, we were faced with an entirely different problem. The various possible complications, such as sinus thrombosis, thrombosis of the jugular bulb and brain abscess, were all carefully considered and finally ruled out. At this time we felt that no radical procedure on the petrous pyramid could, in any way, ward off the inevitable termination. With the persistence and progression in the meningeal signs it was quite evident that we were dealing with a basal cisternal meningitis of the infectious type. However, the presence of a low chloride content in the spinal fluid, which dropped to as low as 410, and positive Levinson tests on a number of

occasions brought up the possibility of a complicating tuberculous meningitis.

Some authors consider a low chloride content in the spinal fluid as pathognomonic of tuberculous meningitis. Without going into a discussion on this subject, we wish to mention the study of another similar case of meningitis by one of us (A. S.), which showed the same spinal fluid findings and positive Levinson tests. The clinical diagnosis was tuberculous meningitis, which histologically proved to be of an infectious type. From this one might deduce that the chloride content of the spinal fluid in meningitis, at least late in the disease, is indicative of the chronicity of the pathologic process rather than that due to the tubercle organism.

In view of the clinical picture, the pathological findings are of importance. First, the suppuration in the ventricles that caused a tremendous dilatation of the ventricular system and which amounted to an intraventricular abscess. This is an infrequent complication, and it is very interesting to note that, despite the severe amount of pressure in the ventricles, no generalized convulsive seizures occurred. The question arises whether or not the suppuration in the ventricles was an early invasion, due to the fact that the cerebral spinal fluid pressure in the early stage of the meningeal involvement registered 40 mm. of mercury pressure. The sudden drop to 4 mm. of mercury pressure could, therefore, be explained clinically by the dense exudate obstructing the foramina of Luschka and Magendie, causing an acute internal hydrocephalus. A curious phenomenon was the freedom of the subjective symptoms when this occurred, although the neurological signs of paralysis and meningeal irritation were intense.

Leroux¹ in a French journal reports a similar case of suppuration of the ventricles. He believed the invasion of the infection from the petrous bone first involved the ventricular system and claimed that his was the only case of its kind reported in the literature, and concluded that he was unable to explain the phenomenon. The appearance of the chills and fever, in his case, following a quiescent period, brought up the same question as to differential diagnosis and, as in our case, necessitated exploration for cerebral abscess. In our patient, we could follow the mechanism of the developing internal hydrocephalus by the daily repeated spinal drain-

ages, all of which had manometric readings and were correlated with the clinical neurologic picture.

The extension of the infectious process to the ventricular system is difficult to explain. Eagleton,⁵ on the basis of anatomical investigation, attempts to solve this problem. He describes a fair-sized vein which he names the "*vena cerebella lateralis*," which communicates laterally with the superior petrosal sinus and mesially with Rosenthal's vein. Eagleton believes that, through this lateral vein, retrograde thrombophlebitis, which has originated from the superior petrosal sinus thrombosis, secondary to mastoid disease, or, to suppuration of the petrous apex, may also reach the deep ventricular system.

In our case, the superior and inferior petrosal sinuses at postmortem did not show thrombosis. The pathologic changes in the petrous bone, according to Dr. Konzelman, were those of a very mild, low grade chronic osteomyelitis. He also noted very cellular areas in the perivascular spaces in the involved pyramid. Dr. N. Winkelman, who also examined sections of the affected petrous pyramid, failed to find any evidence of active inflammation and stated that the picture was rather a nonspecific osteitis fibrosa without the slightest suggestion of an active osteomyelitis. It is conceivable from these findings that organisms breaking into the vascular channels could be carried to the ventricular structures, causing an ependymitis and a suppuration in the ventricles.

In considering the pathologic changes of the involved bone, one is amazed to find so little pathology. Serial sections of the affected petrous pyramid revealed that the bone was of the diploic type and did not show the evidence of any acute inflammatory process, thus ruling out the specific lesion of empyema of the petrous pyramid of Kopetzky and Almour, as well as the acute osteomyelitis of the petrous bone, as described by Eagleton.

The question arises: Of what significance is such a comparatively mild pathologic process in the bone, as was present in our case, when it occurs during the course of an acute suppurative otitis media? It has been definitely demonstrated that the petrous pyramid, as well as the mastoid process of

the temporal bone, undergoes changes that can be recognized by Roentgen examination (Taylor) during an acute middle ear infection. That this change in the bone may or may not produce symptoms was well brought out by the studies of our case. Whereas, in the beginning, the very mild pathologic process in the petrous bone produced the Gradenigo syndrome, later this same process was present without producing any symptoms during the "quiescent period." Furthermore, it is quite possible that the many cases of Gradenigo syndrome which recover show this type of bone pathology. It is also well known that other cases with this condition go on to a fatal termination, irrespective of the treatment, as was present in our case. It, therefore, appears to us to be virtually impossible, at times, to differentiate the cessation of the symptoms which may be indicative of the cure of the disease, from the dangerous "quiescent period," which is the forerunner of the fatal meningitis. Undoubtedly, there may be a number of factors that play a part in the ultimate outcome, such as the constitutional development, the virulence of the infection and the resistance of the patient.

In the literature, infection of the petrous bone, as a complication of acute otitis media, has been referred to as "petrositis," a term introduced by Profant. The cases that are described under this name fit in with the more specific syndromes described by Kopetzky, Almour and Eagleton. It is also referred to those cases of Gradenigo syndrome that improve with conservative measures. It appears to the writers that it would be of distinct value if there was some attempt to use a uniform nomenclature in infections of the petrous pyramid, such as: 1. Empyema of the petrous pyramid with a definite symptom complex, as described by Kopetzky and Almour; 2. osteomyelitis of the petrous pyramid as brought forth by Eagleton; and 3. petrositis, limited to those cases that show Gradenigo syndrome fully developed and which usually improve under conservative measures. This type will show in the acute stages mild changes in the petrous bone by Roentgen examination, similar to those found in the mastoid during the course of an acute suppurative otitis media. The pathologic microscopic appearance of the bone, following the acute phase, shows an increase in the fibrous elements, as evidence of a previous low grade inflammatory change that

does not produce symptoms, but, as in our reported case, may be instrumental in causing other complications.

Finally, in considering all the aspects of our case, in the light of the remarkable contributions to the solving of the problem of petrous pyramid infection, one must confess that in a limited number of cases the question of recovery or fatal outcome cannot be predicted.

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**STAPHYLOCOCCUS ALBUS SEPTICEMIA SECONDARY
TO MASTOIDITIS AND SINUS THROMBOSIS.
OPERATION AND RECOVERY.
REPORT OF CASE.***

DR. GEORGE D. WOLF, New York.

The invasion of the blood stream by the staphylococcus organism is usually serious and, fortunately, uncommon. Lillie and Stevens¹ reported a case of staphylococcus septicemia in a child, following measles, complicated by otitis media and sinus thrombosis. The patient, in addition to ligation of the internal jugular vein and obliteration of the lateral sinus, received an intravenous injection of gentian violet solution and a blood transfusion, and made a complete recovery.

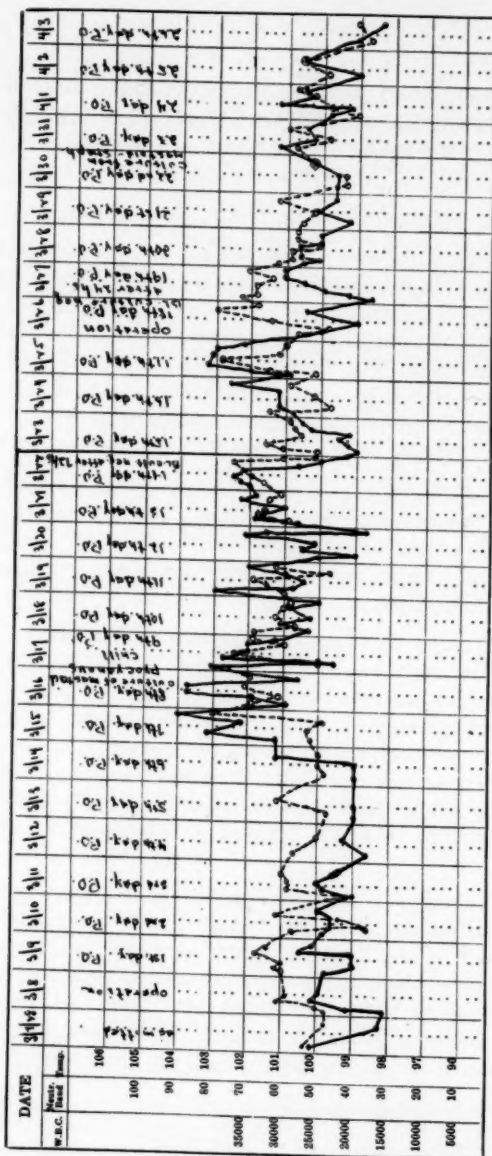
In the case here reported, no intravenous medication was used and the patient recovered after the usual surgical procedure. Emphasis should, however, be made of the fact that this patient was an adult, of fair health and resistance, and that the disease was unilateral.

J. De M., age 40 years, female, married, presented herself at the office with a history that two weeks previously, following grippe, she developed a severe right earache. The eardrum had been incised about a week previously by her family physician, who referred the patient to me. Her chief complaints were severe right-sided hemicrania and ear discharge. On examination, there was considerable mastoid tenderness and radiograph showed marked involvement of the right mastoid.

At operation, a coalescent mastoid was found with a pyocyanus infection. She ran a postoperative temperature between 99° F. and 101° F., and was generally comfortable. On the seventh postoperative day, she had a chill and her temperature rose to 104° F. A blood culture showed the presence of staphylococcus albus. A jugular ligation with obliteration of the lateral sinus was performed. A large mural clot was

*From the Otolaryngological Service of the Sydenham Hospital.

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removed from the sinus, and this likewise showed a staphylococcus albus organism. She made an uneventful recovery and was discharged on the thirty-third day after admission.

Three weeks after leaving the hospital, the patient developed a very severe and extensive erysipelas, involving the whole back from the neck to the buttocks, temperature fluctuating from 99° F. to 106°F. No erysipelas antitoxin was used, and supportive treatment and cold, wet compresses were applied to the lesions. At the end of two weeks, the process subsided and the temperature returned to normal.

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DIATHERMY IN TREATMENT OF CHRONIC DEAFNESS. A NEW TECHNIC.*

DR. D. M. YAZUJIAN, Trenton, N. J.

Advanced chronic catarrhal deafness is one of the most baffling diseases for the otologist. In the past our attitude towards patients suffering from this disease has been to put them through various tests, make the diagnosis, render an unfavorable prognosis and commit them to the tender mercies of the quack or at best to advise them to learn lip-reading, or to use mechanical devices to amplify sounds. The cases I am referring to are those in which the low tones are obliterated, high tones shortened and bone conduction coming near to or surpassing air conduction.

The chief pathological processes we have to fight against in these cases are hypertrophy and later fibrosis of the tympanic structures.

The otologist from the beginning has availed himself of physiotherapeutic measures, such as politzerization, catheterization and vibratory massage; and when the physicians in other fields of practice began using diathermy, the otologist did not lag behind, and such men as Hurd, Dillinger, Stewart, Waring and others have been doing pioneer work in surgical diathermy.

We know that heat has a relaxing effect on spastic conditions in general. A number of years ago, the writer began his experimentation of applying heat to the ears through diathermy, specially for the cure of chronic deafness, and this paper is a brief resumé of his investigations and results. He, like others, at first applied diathermy to the ears by the indirect method; that is, by connecting the active pole of the diathermy outlet to the patient by having him sit on a charged pad, and "drawing" the current with his fingers; later, by the direct method; that is, instead of drawing it with the fingers, putting in the ear-electrodes connected to the active pole of

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the outlet. But, by neither of these methods was the object of diathermy (heat *through* tissues) achieved; in other words, the current did not pass through the middle ear, as it was intended, because we know that high frequency current is converted into heat where it meets resistance, and in the way it was being used it met this resistance at the *mouth* of the meati—far from the region where it was needed. We also know that when two electrodes of equal size and surface are connected, one to the active and the other to the inactive binding post of the diathermy outlet, and these electrodes are applied to the opposing surfaces of any tissue, the field of current action will be the part of the tissue intervening between these electrodes.

The writer thought of utilizing this principle in the case of ears, by placing two electrodes connected with the indifferent post of the medical diathermy outlet, one in each nasal passage, going over its floor and resting in the posterolateral niche of the epipharynx, and by connecting two other electrodes to the active post of the medical diathermy, and introducing one in each ear close to tympanic membrane. This arrangement puts the middle ears directly in the pathway of the current.

In order to effectively apply and regulate the current, I had to devise the following:†

1. *Nose and ear electrodes*: a pair of each, well insulated in their shafts, but the ends left bare. The ends that are to be introduced into the nose and ears are triangular in order to firmly hold the cotton to be wrapped around them; the handles are rough finished to facilitate the wrapping of cotton.
2. The *head-piece* consists of a head-band and two electrode holders. The latter are two metal arches of different colors, with an eccentrically placed, insulated swivel ball with a hole in center. Through the difference in the color of the arches one can tell to which ear each arch belongs. The advantages of this head-piece are: *a.* the ears and the electrodes going into them are always in sight, so that the operator can see where and how far in the electrodes are going; *b.* it is very light in weight; *c.* the ear pieces do not touch the ears or press on them, as they arch over and rest on their contact

†Manufactured by H. G. Fischer & Co., Inc., Chicago.

arms in front and behind the ears; *d.* they are easily adjustable, as they can readily be moved in any direction necessary to align them with the ear canals; *e.* the swivel action of the balls through which the electrodes pass further facilitates the introduction of the electrodes; *f.* the whole head-piece may be sterilized with alcohol or steam.

3. *Duplex current-controller.* The purpose of the controller is to regulate separately the current that goes to each ear. It has five binding posts, the two upper ones are for connecting the cords from the active and indifferent binding posts of the diathermy machine, respectively; the two in the lower corners are for the cords going to ear electrodes, and the third in the middle is for the cord of the nasal electrodes. Each of these three lower posts is finished in different color in order to avoid mistakes in connection.

4. *The cord* is a cable consisting of three finer cords, two to carry the current to the aural electrodes, and the third one to the nasal electrodes. These finer cords have the same colors as the binding posts on the controller and the ear arches, so that the operator can tell at a glance to which binding post and to which ear each cord is to be connected. The cord going to the nasal electrodes is divided near its nasal end into two branches: one for each nasal electrode. The tips of the cords carry fine clips to slip over their respective electrodes. The end of the cable rests in its clip on top of the head-band, from where it sends out the branches.

REMARKS TO THE PATIENT.

Before beginning the treatments certain explanations and directions should be given to the patient. As these cases are very chronic ones, when a patient consults for the first time he should be told that it will take several weeks before any improvement will be seen, and that he should begin to take the treatments with a firm resolve not to be discouraged, and to take them at regular intervals, as directed. In fairness to the patient he should also be told that all cases do *not* improve, and that in the end should he prove to be one of the failures he should not feel disappointed, as he will have the satisfaction of having tried a new method of treatment. Such a frank statement in the beginning is appreciated by the patient, and saves the doctor reflection on his integrity.

The patient should be assured that the treatment is devoid of any pain or shock, and that the heat he will feel in the ears will be very gentle and soothing. He should be made to understand that what is wanted is not heat to the limit of his tolerance, but *comfortable* heat, and that he should immediately report if it gets intense.

The treatments are given during the first three or four weeks three times each week, and later twice per week. If they do not follow each other at close intervals the patient loses during the interval what he had gained.

TECHNIQUE OF OPERATION.

1. The patient should be seated in a comfortable chair, placed to the right or left of the diathermy machine.
2. Cocaine (8 per cent sol.) should be applied once with an applicator to the floor and sides of each nasal passage as far as the posterior pharyngeal wall.
3. While the cocaine is taking effect, cotton should be wound to the triangular ends of the nose and ear electrodes in a *cylindrical* (not conical or spindle-like) way, care being taken that the points of the electrodes are well covered. Cotton thus wound should give the electrode-ends a thickness about 25 per cent more than the insulation on the shafts of the electrodes, and so far as possible, should be equal in all four electrodes.
4. The cotton-covered tips of the electrodes are then dipped in warm normal salt solution and excess of the fluid is gently squeezed out, care being taken not to squeeze them too dry.
5. The ear electrodes are inserted into their respective swivels *from inside outward*. Then, taking hold of the ear pieces and with the straight bar on top of the head-band forward, the operator places the head-band astride over the vault of the patient's head. The ear pieces are moved upward or downward until they are in horizontal alignment with the external meati, when each electrode is gently pushed into its meatus just short of touching the tympanic membrane. The swivel action of the electrode-ball facilitates the introduction of the electrode, saving the patient discomfort. Should the electrode touch the drum, which fact will be announced by

the patient's wincing, it should be pulled out about 1/16-inch to save irritation then and during the treatment by the current.

6. Next, the nasal electrodes are introduced in contact with the floor of the nose and until the posterior pharyngeal wall is reached.

7. Over the outside ends of the aural and nasal electrodes are slipped the clips of their respective cords, which as mentioned before, have their distinguishing colors. When one ear only is to be treated, the electrodes belonging to that side alone are connected, and the cord belonging to the untreated side is disconnected on the current controller.

8. The dials on the duplex controller are set at maximum and one of the gaps of the diathermy machine is slowly opened, or if it is a newer type of machine with fixed spark gaps, the controller is turned on until the meter registers 60 m.a. *Under no circumstance the meter alone should be depended on*, as in my experience, meters as well as patients' resistance vary. *The only reliable guide should be the patient.* For the first few seconds during which the cotton tips are getting warm the current should not be advanced. The patient should again be told that comfortable heat is what is wanted and that if the heat gets intense he should immediately tell the operator. If one ear begins to feel too hot while the other is still cold, the controller connected to the hot side should be retarded. If both ears get too hot the current should be reduced by the main controller of the machine, or by retarding *both* knobs of the controller.

The aurist himself should attend to the above technique, because a technician or nurse, not understanding the anatomy of the nose and ear, may do much harm in applying the electrodes. After all the technical points have been attended to by the physician, the technician or nurse may then be trusted with the control of the current, which is liable to show variations, and see to it that the patient is getting enough heat to feel comfortably warm in both ears, but no more.

9. The treatment should last 15 minutes, at the end of which the current is turned off at the main switch, the ear electrodes are pulled out, the cord clips are disconnected, the

nasal electrodes are removed and the head-piece lifted up and removed from the patient's head.

10. *Immediately following* the diathermy treatment, pneumatic massage is given, which is followed by appropriate sprays and politzerization or catheterization.

Two years ago I reported several cases of very chronic deafness[‡] that had improved to such an extent that they could hear ordinary conversation. Since then I have had a number of other cases with similar results. I am so much encouraged with the results that I consider othotherapy as past its experimental stage and taken its place among our well established armamentariums for fighting deafness. I was pleased to know that Dan McKenzie, of London, is using[§] with good results, diathermy in his deafness cases, although not as chronic as the ones I have referred to. His technique is different from mine and perhaps that is the reason why he confines its use to more recent cases. In my limited experience, if treatments are persevered in, about 50 per cent of these old cases will improve to the extent of hearing conversation.

CONCLUSIONS.

1. Many cases of advanced catarrhal deafness are amenable to the combined diathermy treatment.

2. Diathermy in the ordinary chronic deafness is a valuable adjunct to the routine treatment.

3. The treatments must be taken without interruptions or without too long intervals in between.

4. The technique must be carefully carried out by the otologist *himself*, in order to obtain good results, as well as to avoid harmful effects.

5. *Othotherapy without vibratory massage and inflation immediately following it is not of much value.*

6. I have reasons to believe that besides chronic catarrhal deafness, recent nerve deafness, following such infections as erysipelas, and chronic discharging ears are benefited by othotherapy.

7. Chronic nerve deafness and otosclerosis cases are *not* benefited by it.

562 E. State Street.

[‡]See Journal of the Medical Society of New Jersey, Feb., 1933.

[§]See British Journal Phys. Medicine, July, 1933.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTOLARYNGOLOGY.

Meeting of May 16, 1934.

(Continued from February issue.)

The History of the Surgical Treatment of Otogenic Abscess of the Brain. Dr. Leo M. Davidoff.

(To be published in a subsequent issue of THE LARYNGOSCOPE.)

DISCUSSION.

DR. JOSEPH E. J. KING: Mr. Chairman, ladies and gentlemen: I came here to learn this evening, not to talk. I certainly appreciate Dr. Davidoff's paper. This is the first really detailed historical account of the treatment of brain abscess that I have heard, I think. I have heard some shorter accounts. I personally think, as far as the method of operation is concerned, that it makes very little difference what method one uses, if that method makes the patient well. I am quite well acquainted with Coleman's cases. I know something about Dr. Elsberg's results and those of Dr. Grant. Of course you are all acquainted with Macewen's results. I do not think there is any one method, and I do not think there is any one combination of methods, that will cure all brain abscesses, or anything like all brain abscesses, that is if you include everything, such as multiple abscesses, abscesses with meningitis, oncoming abscesses that are not yet abscesses, but a suppurative cerebritis or encephalitis. There has been a considerable amount of interest aroused in this subject in the last 15 or 20 years, out of which I think will come a great deal of knowledge which will result in a greater number of cures as compared with the past, outside of Macewen.

The time of operation, as Grant stated in his paper last year, I think is more important. As Dr. Davidoff has said, in the past it was considered as an emergency, very much like a ruptured appendix or an intussusception, and that the operation should be performed at once. Now we know that is not necessary. In fact, the best results perhaps are obtained if we can wait, everything else being equal (if the patient himself and the doctors can wait) for the time of encapsulation. At that time I think that an ordinary, non-complicated, temporosphenoidal lobe abscess, by and large, will recover in the majority of instances. I am not talking about cerebellar abscesses.

Years ago, when I first started doing neurological surgery, I did not have very good success with the tubes. It may be I did not use them properly. I noticed that the other surgeons did not have very great success either. An occasional case recovered, maybe two or three, but no one produced a series of cases that got well one after another. Nor did they expect by their methods that the next case would recover with any definite amount of assurance. I remember that in 1920 I was called upon by Dr. McCoy and Dr. Craig to operate upon a case of temporosphenoidal lobe abscess at the New York Eye and Ear Infirmary. For drainage I used a fairly large rubber tube placed in the abscess cavity and held in position by light packing of gauze. It was not fixed to the scalp. Later at successive dressings I noticed that the tube was not staying at the same depth as originally, but that it was being shoved out farther from the scalp. By the seventh day it had been shoved out of the intracranial cavity, become completely dislodged and there existed a cerebral hernia. At the time several of the men saw the case and said that the patient would die, and advised that I cut the hernia off with a knife. This was not done. The patient recovered with dakinization of the hernia. Just

two weeks after that I had a similar case at Fox Hills, who was very much improved on the day following operation. The drainage tube stayed in place for quite a while. The doctor who dressed the patient decided to take it out and I had to replace it. This situation recurred two or three times and the patient finally died. A short time later I had another patient in whom the tube was displaced. An assistant attempted to replace the tube but instead of putting it into the tract from whence it came it was thrust into the brain tissue itself. This patient died. I then decided that I would attempt to do what accidentally occurred in the first case done at the New York Eye and Ear Infirmary; that is, to make a fairly large opening into the abscess cavity and allow it intentionally to herniate. In the past I have found that herniation was allowed to proceed too far, farther than necessary. Herniation of the abscess cavity itself, with complete eversion, is as much as one desires, and lately we have controlled herniation by lumbar punctures.

I want to mention just two or three cases that I have had that recovered. Eleven cases have recovered. In the past four years only one patient in seven died in which there was a suitable abscess for operation. By this I mean a well encapsulated abscess in which a meningitis, a pre-existing pneumonia or some such complication was not concomitant. One patient had pneumonia at the time of operation and this patient died. This series includes multiple abscesses following a previous operation and an enormous abscess which after evacuation required over seven ounces of saline to fill the cavity. I do not see how a drainage tube could have possibly cured either of these cases. In one case the remaining tissue between the ventricle and the abscess cavity was so thin that if the herniation had not been controlled by lumbar punctures the ventricle certainly would have ruptured from within out. Another case was one of metastatic abscess of the parietal region which was operated on, upon the advice of Dr. Kennedy, about seven days after the original intracranial episode took place. It followed an abscess of the lung. On Sunday morning the man was driving a car and by Sunday night he was unconscious. On admission to the Manhattan Eye, Ear and Throat Hospital he presented complete right hemiplegia, marked right hemihypaesthesia amounting almost to anesthesia, a right homonymous hemianopsia and aphasia. I did not want to operate upon him, of course, because we have been taught to wait for encapsulation to take place. I did operate, however, upon Dr. Kennedy's advice. Pus, broken down brain tissue and detritus were found. I knew of no method which, to my knowledge, I could have employed, so I sucked out quite a large amount of this broken down tissue, but at the same time did not remove all of it for fear of entering the ventricle. I stuffed the excavation in the brain lightly with fluffed iodoform gauze. This man recovered in about 42 days, which is a little longer than it takes for an abscess to encapsulate. This abscess, had it progressed to complete encapsulation, would have been a huge destructive one. So, even though this case was one of suppurative encephalitis or cerebritis, he recovered. I do not know that I would advocate this method in all cases of suppurative cerebritis, because I do not know enough about it, but it may in the future lead to possible recovery of some of these cases.

Until I have more difficulty than I have had in the last four years with the procedure which I have advocated, I think that this procedure will be used by me in cases of cerebral abscess, but not for a cerebellar abscess. The majority of cerebellar abscesses, I think, are more or less fixed anteriorly and they therefore cannot herniate. I believe that the best procedure for cerebellar abscesses is one in which a single drainage tube is used and fixed in position to the scalp for a long time. I would not attempt to use my method in cerebellar abscesses unless all of the abscess is in the cerebellar lobe itself and not attached anteriorly. I intend to publish my case reports in detail soon. I have published but little since 1924 because I did not think I should until I had something fairly substantial to show. However, this series of 11 recoveries and three deaths in cases complicated by meningitis and a pre-existing pneumonia makes a fair record.

I want to thank you for your attention.

DR. HENRY M. SCHEER: I have enjoyed Dr. Davidoff's paper. I think it is one of the rarities in historical presentation of brain abscess. It is instructive and every one of us has profited by it.

About three years ago I presented one case report of a temporosphenoidal abscess, otogenic in origin, following a chronic discharging ear. A radical mastoidectomy was performed and shortly after the mastoidectomy the symptoms pointing to abscess occurred. I want to cite just a few points. That patient, a girl of 17, is alive today. I want to say just a few words, in view of the historical presentation, about what occurred at the time of that operation and its postoperative care. The approach was through the mastoid wound. The difficulties that arose were due to the use of rubber tubing as drainage. The mastoid wound filled in and granulated in so rapidly, in spite of packing off around it, that I had great difficulty in retaining the tube as placed into the brain. As has been so well pointed out here tonight, one of the difficulties was that it slipped out very frequently, and after the first week particularly, I found great difficulty in replacing it. As the second and third weeks went by, the wound was so well filled in and the tube so difficult to replace, with fluid still draining from the brain, that I used what we then used at the Manhattan Eye and Ear Hospital, a sirious drain. This is a very porous, fibre tubing which comes in various sizes. It is one type of drainage which Dr. Davidoff did not mention. I used a very large size. It is very flexible. Not being able to insert it through the mastoidectomy wound, I inserted it in the opening in the brain through the external meatus. A plastic had been done at the time of the original radical mastoidectomy. In that way I was able, in spite of the fact that the mastoidectomy wound was filling in posteriorly, to replace the sirious tube drain in the brain. It is very flexible, not rigid. I was able to keep the drain in until three or four weeks had passed by. It was slowly shortened until all drainage ceased. As I said before, that patient is alive and well.

DR. LEOPOLD GLUSHAK: I would like to pass a few remarks on the historical part of the presentation tonight. You can readily understand the reason for my getting up, after I heard two of my illustrious teachers mentioned, Dr. Macewen, my professor of surgery, and Dr. Barr, my teacher of diseases of the ear. It is very interesting that I should be a living testimony, not only to the paper of Dr. Davidoff in his mention of Macewen, but also to the article mentioned by Dr. Elsberg of Dr. Barr. I assisted Dr. Barr at the ear hospital and one day he related to me the case and indicated that he did not have the courage to go in on the brain abscess and had called in Macewen to do it for him. Macewen was a genius, and probably his greatness was due to the fact that he did not believe in empiricisms and was a great advocate of criticism. He did not believe anything that was passed along unless he experimented and proved it to himself to be the logical thing to do. He was not accepted with great enthusiasm by his confreres, although much admired by his pupils and on the European continent. His book on pyogenic infections of the brain and the spinal cord was quickly translated into German and quickly sold out. In 1920, I saw Macewen, on a visit to Glasgow, and asked him if he would ever republish his book and add to it. He said, "There are a great many things to add, and I probably will." But age was written on his face and unfortunately he passed into the Beyond before he rewrote this book. Probably all the information left behind is in the hands of his son, Jack Macewen. I well remember the words Dr. Elsberg read from the paper, "Drainage from the most dependent portion, as large a drainage as possible, and as long as possible." I rise to comment in deference to the memory of my two masters.

AMERICAN LARYNGOLOGICAL AND OTOLOGICAL SOCIETY, INC.

Fortieth Annual Meeting, April 3, 1934.

Symposium—Newer Clinical Approaches in Otolaryngology.

1. **Nutritional Influences.** Dr. William Weston, South Carolina Food Research Commission, Columbia S. C. (By Invitation).
2. **Sympathetic Influences (Autonomic Level).** Dr. Francis B. Blackmar, Columbus, Ga.
3. **Insulin Therapy.** Dr. Samuel M. Beale, Sandwich, Mass. (By Invitation).

DISCUSSION.

DR. D. C. JARVIS: These newer clinical approaches in otolaryngology bring home to each one anew the relationship existing between upper respiratory tract symptomatology and systemic dysfunction. That a cog slipping elsewhere in the body may be responsible for the symptoms in the nose and throat, and until that cog is once more doing its work properly local treatment will be of little avail.

I have learned many things from the writings of Dr. Weston. First, I have learned to see in the patient's food intake its chemical content and from this I have learned that an individual may cross his line of tolerance for minerals in organic form as well as minerals in inorganic form. I find my primary interest is no longer in calories, fats, carbohydrates, proteins, vitamins and the ash content of foods. Primary interest is rather in the chemical content of the individual's food. I realize now that the so-called alkaline ash food is a good source of potassium and iodine, and if an individual crosses his line of tolerance for potassium and iodine in organic form he will develop a watery discharge from his nose, a mild brow ache, an itching skin and a slight edema of his larynx, bringing to him an unable speaking voice in much the same manner potassium and iodine would in inorganic form, only in a milder degree. As he crosses his line of tolerance for potassium and iodine in organic form the mucous membrane within his nose takes on a pallor so that one examining the nose of a patient and finding a pale mucous membrane present would inquire as to the patient's food intake in order to determine whether it represented a source of potassium and iodine in organic form.

I realize now that the so-called acid ash food represents a vehicle for carrying sodium chloride into the body. If an individual crosses his line of tolerance for sodium chloride he will develop a dry nose and there will be a burning sensation present. The mucous membrane within the nose shows an increased redness which when present leads one to inquire the patient's food intake in order to determine whether it has been a vehicle for carrying sodium chloride in increased amounts into the body. A study of the patient's food intake from the viewpoint of otolaryngology brings an interest in its chemical content and the relationship of this chemical content to upper respiratory tract symptomatology. For there seems to be a chloride iodine balance, a sodium potassium balance and a calcium phosphorus balance, all manifesting themselves by a characteristic appearance within the nose. I am very grateful to Dr. Weston for the things I have learned from his writings.

Let us consider for a few moments the splendid paper presented by Dr. Blackmar. For some time we have had access to and have been more or less familiar with facts relating to the autonomic nervous system. The difficulty has been in applying these facts clinically. Dr. Blackmar is teaching us how to make clinical application of these facts and I for one am grateful

to him for this knowledge. We now associate certain clinical conditions with a dominant sympathetic and other clinical conditions with a dominant parasympathetic. We are beginning to realize that mucous membrane color changes whether in the nose, throat or rectum, mirror the autonomic level. A marked increase in redness of mucous membrane points the way to a dominant sympathetic while a corresponding degree of pallor points the way to a dominant parasympathetic. We expect the infections with a dominant sympathetic and the allergies with a dominant parasympathetic. Therapeutic measures line up on the basis of whether they raise or lower the autonomic level. When the sympathetic is dominant iodine in some form seems to be the therapeutic agent of choice as represented by three drops of tincture of iodine in a glass of water at three hour or more intervals, in keeping with the severity of the clinical condition. When the parasympathetic is dominant then dilute hydrochloric acid in dosage ranging from 15 to 40 drops in a glass of water each mealtime seems to be indicated.

In relieving pain two to three times as much morphine is required when the sympathetic is dominant, shown by an increased redness of mucous membrane as when the parasympathetic is dominant as shown by a pale mucous membrane.

Now let us consider this paper on "Newer Clinical Uses of Insulin," presented by Dr. Beale. This work of Dr. Beale's opens a whole new book in otolaryngology. Ulceration of tissue, mucopurulent discharge, scab formation within the nose and new growths are all seen in a new light, the light of a low tolerance to carbohydrates. This carbohydrate tree as it grows and develops discloses more than the branch labeled diabetes. There are branches labeled ulceration of tissue, purulent discharge, scab formation within the nose and new growths. For some time I have been studying the intranasal appearance of private surgical patients at the Barre City Hospital and have discovered there are three degrees of carbohydrate intolerance which manifest themselves within the nose. The first degree is characterized by the appearance of mucous bridges extending from the nasal septum to the outer wall of the nose. These bridges are of a syrupy nature and warrant the suggestion to the surgeon that the carbohydrate intake during convalescence be kept low. The second degree is characterized by mucopurulent bridges extending from the septum to the outer nasal wall. These mucopurulent bridges are white in color and warrant the suggestion that not only the carbohydrate intake be kept low, but also that chlorophyll as represented by powdered spinach be taken daily to raise carbohydrate tolerance. The third degree is characterized by dried secretion present on the nasal septum and anterior ends of inferior turbinates in addition to mucopurulent bridges. This condition warrants the suggestion that not only the carbohydrate intake be kept low during convalescence, but four units of insulin be given daily. Under four units of insulin daily in three days' time such a nose will show a clean mucous membrane free from scab formation.

The relation of infection to a low carbohydrate tolerance is an interesting one. A profuse purulent discharge will have nearly disappeared in five days when five units of insulin each day is added to the treatment. There is considerable clinical evidence at hand which leads one to suspect that five units of insulin once daily will be added to the present treatment of sinus disease showing a prolonged discharge. One has but to observe the quick response of corneal ulcer to five units of insulin once a day after all the usual methods of treatment had failed to appreciate the relationship existing between low sugar tolerance and insulin.

We are indebted to Dr. Beale for bringing to our attention the wide range of clinical conditions in which small doses of insulin daily are of great clinical benefit.

DR. IRA FRANK: Dr. Weston has presented a most interesting paper and one which supplies abundant food for thought. Selection of an adequate diet is a matter of great importance for the maintenance of animal life and consequently is a subject which affects practitioners in every department of medicine. I think too much cannot be said in praise of the painstaking and effective work which the South Carolina Food Research Laboratory has accom-

plished and for their valuable studies in nutrition. What effect the deficiency of iodine may have on the upper respiratory organs is not definitely known, but could very well be a fruitful field for research by those who are interested in the broader aspects of otolaryngological diseases, its etiology and pathogenesis.

I am greatly impressed by the fact which Dr. Weston calls attention to, namely, the large number of poisonous fungi which may be found in cereal grains. The practical application of this finding in the etiology of disease must be of interest to every physician in every department of medicine. This is an unexplored and uncharted field, and presents possibilities for research and discovery which are yet undreamed of.

Dr. Weston has called attention in a most interesting way to the variable physical and mental standards, depending upon the climate and the diet of various races, and most interesting to us is the study of diets which are deficient in fat. This necessarily implies a deficiency in the fat soluble vitamin A. It is known from many clinical experiences that the absence of fat from the diet may produce xerophthalmia, other eye affections and various catarrhal disorders and ear abscesses. One may readily understand that if the absence of vitamin A may cause ophthalmic disease, the same deficiency may also produce degenerative changes in other tissues and organs.

The absence of vitamin B from the diet should also arouse the apprehension of the otolaryngologists. Just as this deficiency of vitamin B may cause neuritis in the peripheral nerves, so it also may produce inflammatory changes in nerves supplying the special sense organs.

The group under the leadership of Dr. Jarvis has frequently called attention to the effect of improper diet on the lymphoid structures of the upper respiratory tract. This group has stressed the varying reactions of the nasopharyngeal mucous membrane, depending upon the chemical reaction produced by the diet.

Though the presence or absence of vitamins may influence the character of this reaction, it is recognized also that vitamin D has a definite influence on calcium metabolism, and the prevention and cure of rickets. As Dr. Weston suggests, an insufficient supply of vitamin D may cause a malformation of the malleus, incus and stapes, just as this deficiency causes changes in the function and structure of the skeletal bones.

Thus it is seen that the students of nutrition, as stated by Dr. Weston in his paper, bring important problems to us for consideration. We must study carefully and in fuller detail the dietary relations and vitamin deficiencies as they pertain to the etiology as well as to the prevention and curative treatment of the otolaryngological organs. It is not sufficient that they be studied simply as local disease processes, but also as indicators of defective metabolism in the entire human body.

The paper of Dr. Blackmar is particularly interesting to me because it deals with the pale septum, which I have previously discussed as possibly affording some hint of faulty body chemistry. Evidently, if we plan to distinguish facts from fancy in this complicated field, we must find methods of collecting statistics with great care and regarding each statement that we make. For instance, on the clinical record of each patient we should record from time to time the color index of the septal musoca, using at least the Tallquist paper if no better method is available. On the same days we can have the patient tested for alkali reserve, carbon dioxide tension or Ph of blood. By following the case records of a sufficient number of patients over a prolonged period of time we can hope to eventually learn if there is anything to the theory that the color of the septum is an index of the acid base balance of the blood or of certain tissues.

It seems to me, then, that we can make the most progress if first of all we divide the theory of the speaker into separate statements and examine each one on its own merits. His statements have covered so much ground that the best way I have found to summarize them for myself, so that I can remember the gist of them, is to put them in the form of equations.

(To be continued in a subsequent issue.)

BOOK REVIEW.

Stammering and Allied Disorders. By C. S. Bluemel, M.A., M.D., F.A.C.P., M.R.C.S. (Eng.). New York: The Macmillan Co, 1935. Price \$2.00.

The third of Dr. Bluemel's publications in book form incorporates the theories expressed in the two previous volumes with a somewhat different approach or explanation of them. In this offering his object is to harmonize apparently conflicting points of view of the problem of stammering and its correction as were presented before the American Society for the Study of Disorders of Speech at the Detroit Meeting in 1931.

Dr. Bluemel's theory of transient auditory amnesia and stammering as an impediment of thought remain the nucleus of the theory, but he gives as the cause for both an inhibition or recoil of sound from the mind which breaks the continuity of consciousness. He has taken the Behavioristic viewpoint as his theme and introduces his new approach with an explanation of the conditioned reflex together with citations of Pavlov's experiments. In a Behaviouristic trend he assumes that it is by reason of the conditioned reflex that speech is established and language is developed. His theory of primary and secondary stammering as presented at the Detroit meeting is correlated with this idea. He says that primary stammering is the resultant stammering after a partial inhibition caused by some shock or unusual happening. This he says is the result of conflict between the two physiological processes of conditioned response and inhibition. Since the conditioned reflex is not firmly established in childhood, the obvious fact that the onset of stammering occurs more frequently then than in later life is thus accounted for.

Secondary stammering occurs after the reflex is more securely established and is less subject to the hazard of inhibition. In the secondary stage we have emotional conditioning born of emotional distress in the primary stage. This seems to clarify the question as to why stammerers have speech difficulty under certain conditions and with certain people, while in some situations there is little difficulty of articulation and expression.

Several chapters are devoted to Swifts's theory of visualization, Orton and Travis' dominant gradient theory and sundry other theories of emotional disturbances with which Dr. Bluemel is not in complete accord.

Concomitant with the theory that stammerers have never properly acquired the conditioned reflex of speech, the last chapter is devoted to points of treatment to rectify this deficiency.

M. A. McG.

